THE

JOURNAL

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OF

GAS LIGHTING,

WATER SUPPLY,

Etc.

VOL. LXXXI.

JANUARY TO MARCH, 1903.

LONDON:

WALTER KING,

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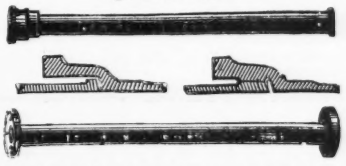

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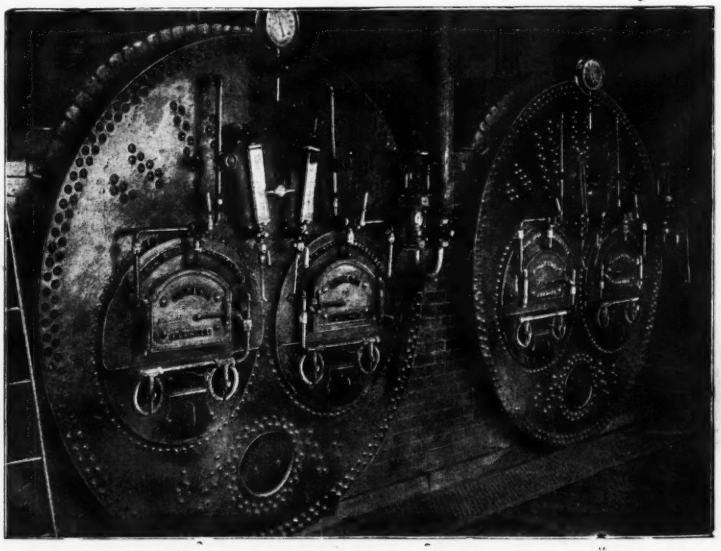

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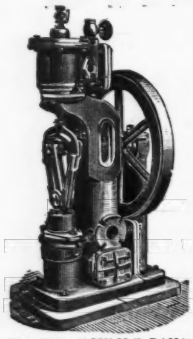

Fig. 705. "SINGLE RAM" STEAM-PUMP.

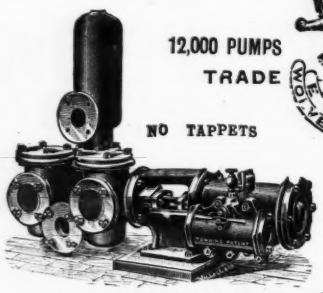

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

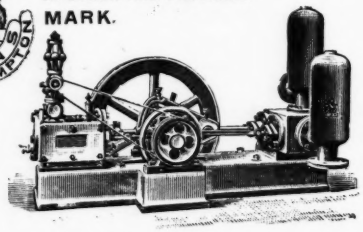

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

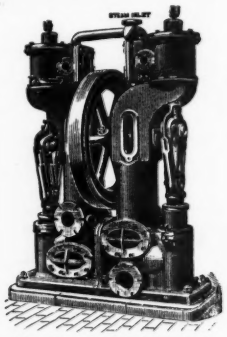

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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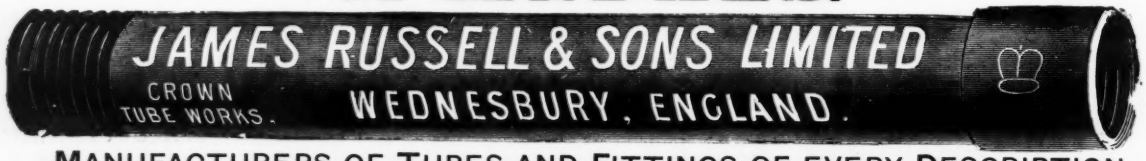

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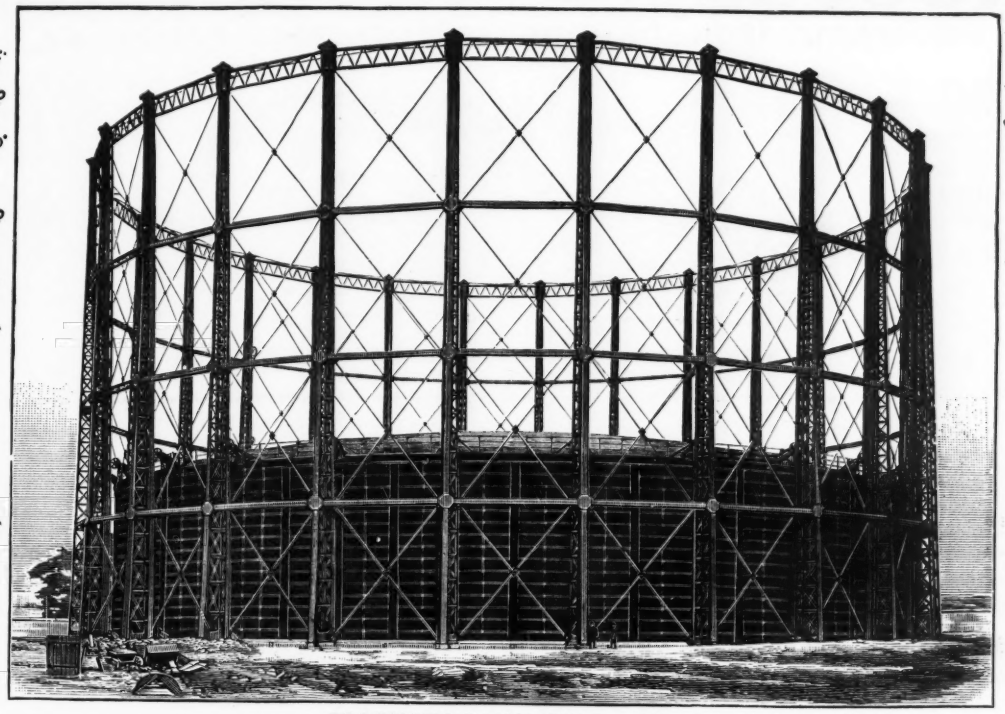

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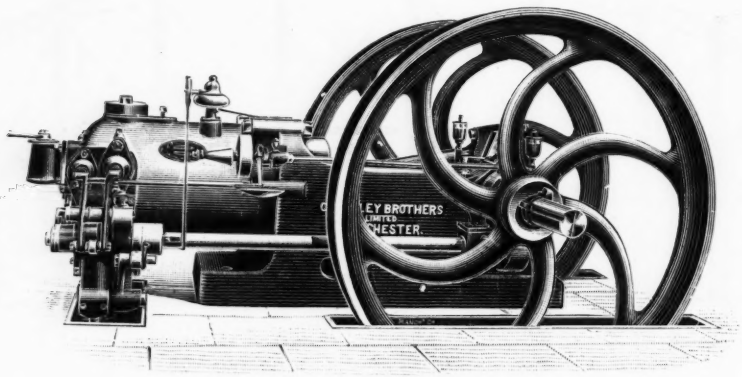

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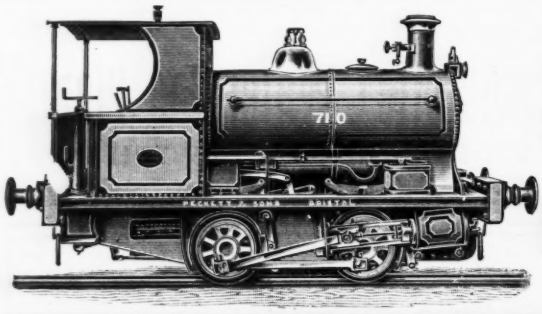

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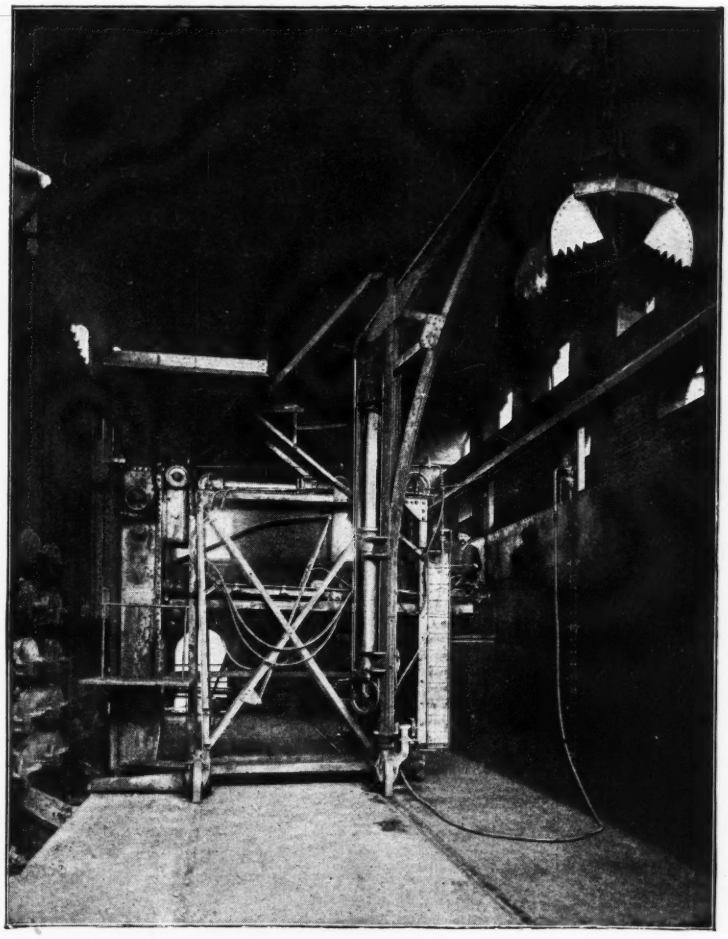

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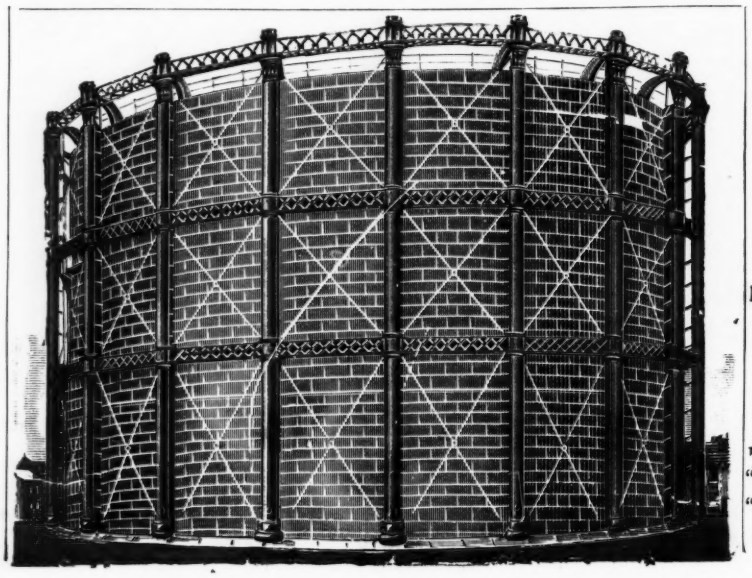

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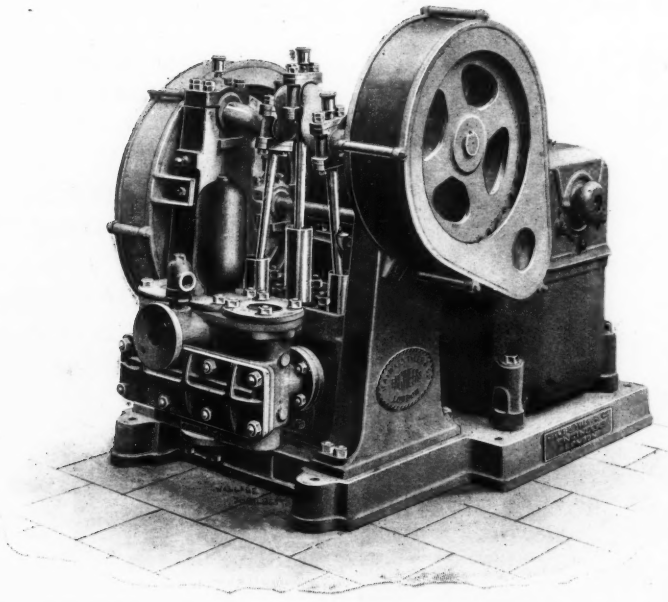

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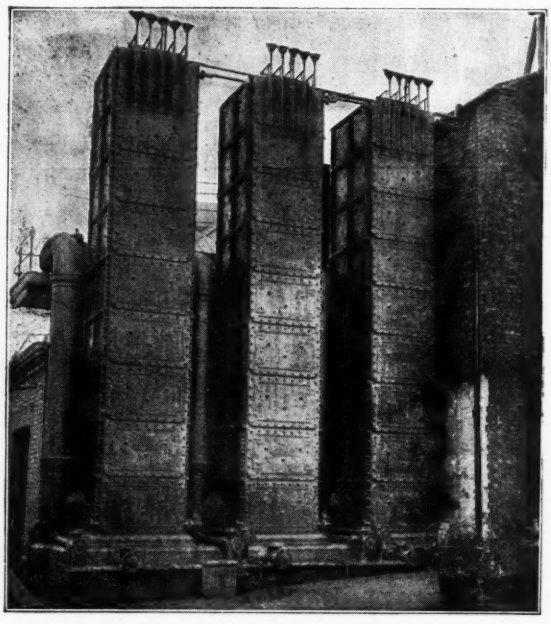

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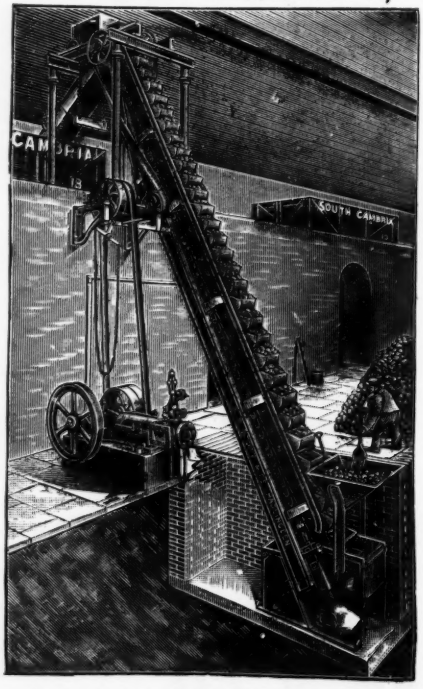

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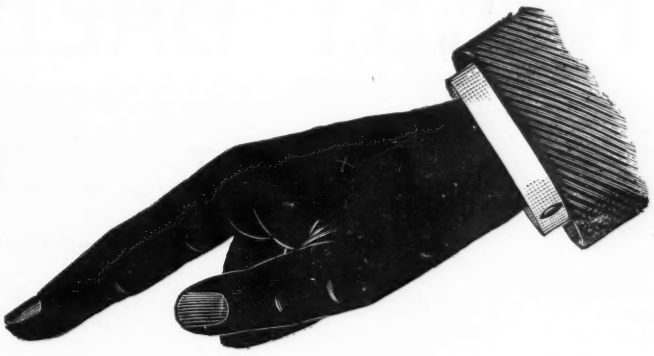

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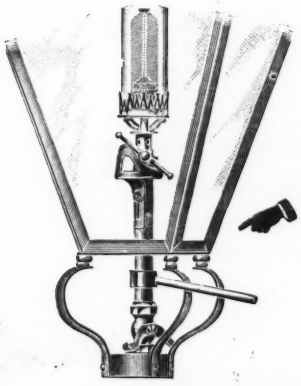

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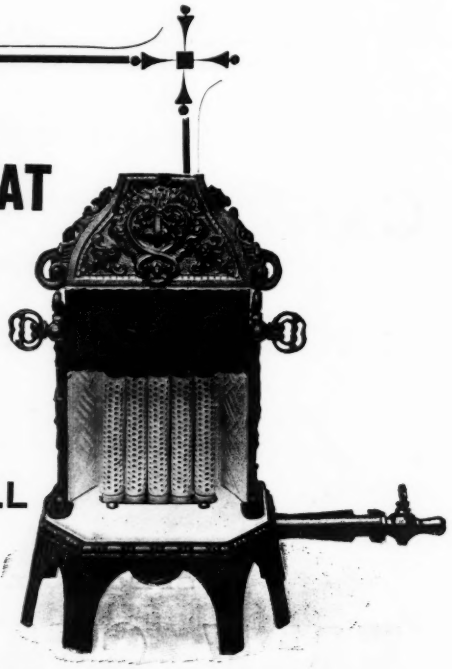

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CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
A Feature of this Volume 13
Parliamentary Business in the Ensuing Session 13
Ratepayers and the New Education Act. . 13
The South Wales Imbroglio 14
Labour Politics and Municipalism in the New Year 14
The New Patent Act. 15
A Word to Our Readers—Trade Unions and their Members—And the Need for Reform 15
WATER AFFAIRS—
Preparing for Action in London 16

ESSAYS AND REVIEWS.

Honorary Membership of the New Institution 17
Rampant Municipalization in Italy 18
The Coal Question in 1902 19
Electric Lighting Memoranda 20
Gas Bills for 1903 20
The Mosely Labour Commission 21
Use of Gas for Warming Enclosed Spaces. . 22
Gas and Water Stock Market. 22
The Granton Works of the Edinburgh and Leith Gas Commissioners 24
The Progress of Gas Consumption in a Suburban District 27
An Inclined Retort-House and Its Working at Bristol 29

COMMUNICATED ARTICLE.

On the Testing of Low-Quality Gas. By John T. Sheard, F.C.S. 28

CORRESPONDENCE.

The Duty of the "Millenium" Burner. . . 42
Incandescent Gas-Burners 42
Inclined *v.* Horizontal Retorts 42
Notable Experiences with Blue Water Gas at Ilford 42
Penalties Attaching to Water Consumers' Offences 42
The Choice of Gas-Fires 42

TECHNICAL RECORD.

The Gas Industry and Cyanide Manufacture . 35
Air-Supplying Apparatus for Continuous Revivification 36
A Clip for Gas-Meter Connections 37

REGISTER OF PATENTS.

Lamps and Lanterns—Tilley, F. C.. . . . 37
Internal Combustion Engines—Thwaite, B. H. 37
Separating Solid Matter from Tar—Davies, P., and the Hydroleum Company. . . . 38
Retort-Charging Apparatus—Wise, W. L. (The Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz) 38
Coin-Prepayment Mechanism for Fluid Meters—Grieve, G. K., and Peebles, W. C.. . . 39
Conveyors for Retort-Stacks—Bronder, G. A.. 39
Burner for Incandescent Gas Lighting—La Société Houdaille et Triquet 40
Lighting Gas-Burners Automatically and from a Distance—Canellopoulos, J. M.. . . . 40
Igniting Gas-Lamps—Haddan, H. J. (Compagnie Belge pour le Fabrication des Compteurs et Materiel Gaz, Eau, Electricité) . . 40
High-Pressure Incandescent Gas-Lamp—Boult, A. J. (The New Process Lighting Company) 41
Mixing Air and Gas for Incandescent Lighting Purposes—Tresenreuter, G. 41
Patent Notices 41

LEGAL INTELLIGENCE.

Gas Stoker Fined for Neglecting Work. . . 42
An Ingenious Prepayment Meter Robber . . 42
Stealing Coke from a Gas-Works 42
Cutting Off a Water Supply 42

MISCELLANEOUS NEWS.

Gas *v.* Electricity for Motive Power. . . . 43
Settlement of Rating Appeals 43
Last Year's Gas Consumption in Manchester. 43
Darlington Gas-Works Extensions 43

MISCELLANEOUS NEWS (*continued*)—
The Crystal Palace District Gas Company's Employees Honour their Chairman—The Inception and Development of Co-Partnership in Gas-Works 43
Stock and Share List 44
Electric Lighting Notes 46
Coal Tar Products in the Past Year. . . . 47
Sulphate of Ammonia and Nitrate of Soda Last Year 48
Metropolitan Water Board—Constitution of the Board 49
Deep Well Borings 49
Notes from Scotland 50
Current Sales of Gas Products 51
Coal Trade Reports. 52

PARAGRAPHS.

New Gasholder at Amsterdam 17
Personal 23
The Late Mr. Mark Knowles—An Attack on Municipal Trading 23
Mr. W. J. Dibdin on Public Lighting—Trade Unionism in England and America—Future of the Gas-Engine 37
St. David's Water and Gas Supply—More Coal in Durham. 41
Stafford Water Supply. 42
Waste Prevention and Water Supply in New York—An Explosion at Wandsworth. . . 52
Sale of the Bottesford Gas-Works—The New Water-Works for Margate—Gas-Workers' Wages at Colne—Sheppey Water Supply—Water-Works for Whittle-le-Woods and District—Discount on Slot-Meter Receipts—Bilston Gas Company—Electrical Thawing of Frozen Water-Pipes—Award in the Overwater Arbitration—Gas-Works Inspection and Testing Experiments at Southport . . 53
Wellington (Salop) District Council and the Gas-Works—Fire at the Wedding Gas-Works in Berlin—Southport Water Charges—Selby Gas Supply—British Coal for the United States 54

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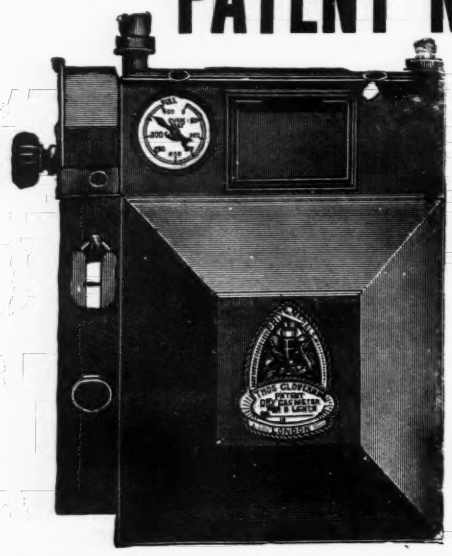

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EDITORIAL NOTES.

A Feature of this Volume.

IT is a pleasure to be in a position to inaugurate a new volume of the "JOURNAL" and another year's journalistic enterprise in the service of the gas industry with a number such as the present one, in which there appears so much of the first order of interest for all actively concerned in the welfare of the industry, whether in its engineering or its administrative domain. It is unnecessary to make specific reference here to the several topics; but it may be pointed out that descriptive illustrated articles of new engineering work are prominent features. The works which come under treatment this week are as widely separated as Edinburgh and Bristol. But it is only in regard to the former that a little explanatory reference is needed here; the article describing the new inclined retort house and the coal and coke handling plant at Bristol being complete in this one issue. Respecting the Edinburgh article, it may be stated that the publication to-day commences the promised description, from the pen of Mr. W. R. Herring, of the new Granton works of the Edinburgh and Leith Gas Commissioners, the first section of which works, as readers are aware, is already in operation. The articles will form a serial running to a considerable length into—perhaps throughout—the present volume of the "JOURNAL;" and they will be accompanied by numerous specially drawn plates, and copiously illustrated by photographs taken as the work proceeded.

Both as a written and an illustrated exposition of complete and latter-day gas-works construction on the large scale—from the surveying, levelling, and drainage of the land, the plotting of the works, and their construction to consummation—it will, in its fulness, stand unrivalled among existing treatises on special gas-works. However much engineers having a preference for the horizontal system of carbonization may disagree with Mr. Herring's choice of the inclined system, they will be at one with us, and with those who are in agreement with him in that particular regard, in thanking him for the pains and trouble to which (we, more than others, know) he has put himself in preparing the material and drawings which will unfold in detail the complete work so far accomplished at Granton, and will give freely, for the benefit, acceptance, or criticism of his professional brethren, the reasons which led to the existence, in situation and form, of the plant and methods as now seen at Granton. Mr. Herring has been so closely identified with the inclined retort system as an extremely militant advocate, that there are those, we fancy, who—not having had the opportunity of visiting the works now standing on the southern shores of the Firth of Forth—are prone to think of the nobly designed retort-house about which they have heard so much as constituting the work of the Engineer there. But as the articles proceed their minds will be disabused of any such idea. An opportunity that seldom falls to the lot of an Engineer of his years, has been given to Mr. Herring at Granton. Of the opportunity he has taken full advantage; and the result is one of which he and his friends are proud. In it are seen the innate expertness, the flexibility of idea, and the comprehensive grasp of detail which reveal (as Mr. James Mansergh would graphically put it) the Engineer "born, not "made." As the publication of the material in our possession progresses, it will, we think, be conceded that this little introductory appreciation is justly deserved.

Parliamentary Business in the Ensuing Session.

IN another column will be found the commencement of our customary abstract of the contents of the Gas Bills which will in due course acquaint the Legislature with the individual requirements of gas undertakings in the United Kingdom for the immediate future. Last week we gave a synopsis of the Private Bill business for the year relating to the Metropolitan and Suburban districts. The space we are able to devote to the same subject this week is wholly taken up with new Company incorporations. Of course, one cannot say how such a record will strike every observer. We should draw the conclusion, with some considerable degree of confidence, that it tells for the vitality and the incessant progress of the industry as a whole. Not all Gas Companies are in Parliament every year; if they were, the cry of congestion of the Committee business of both Houses would be much louder and more insistent than it is. In face of the actual facts, however, this is how the writer in "Engineering" on the prospects of the forthcoming session judges the situation under the heading of "Gas." He remarks: "There is not much of consequence in the list of "gas-works undertakings; the large Companies shrinking "from any very considerable additions in the face of the "development of electricity."

Now, one could not object to any remarks of this kind, if only they were true in substance and in fact. It would be immaterial whether they were made with gleeful satisfaction or with commiseration. Nor would it make the smallest difference in the circumstances whether partisans of the gas industry denied the truth or sought to explain it away. But the observation in question is not merely not true; it is grotesquely erroneous, misleading, and uncalled-for. And one can but feel much surprise that a professedly impartial journal of engineering should be so ill-advised and ignorant of the truth as to circulate it. What evidence is needed to prove the unfounded character of this prejudiced remark? Is it applications of the big undertakings to Parliament for additional powers? Well: The Gaslight and Coke Company are in Parliament; the South Metropolitan were in Parliament year after year, and only last session secured the most extensive land privileges, in view of the requirements not of this but of the next generation of consumers, ever granted to a Gas Company. The other London Company, the Commercial, also obtained a new settlement and capital powers to last them for some years to come. It was the same with the West Ham Company. This year it is the turn of the Crystal Palace District Gas Company, among the larger Suburban Gas Companies, and the Harrow and Stanmore, the North Middlesex, and the Hampton Court Gas Companies among the smaller ones. What next—the Provinces? Birmingham wants land for the gas-works of thirty years hence; and there are others. Does the person who believes that the owners of large gas undertakings are "shrinking from any "very considerable additions" know what they are doing in Edinburgh and Glasgow?

One would not condescend to notice misstatements of this nature in the lesser electrical periodicals or the cheap newspapers, because they must fill up with something, and what they publish does not greatly matter. Yet it would make a considerable difference in the rate in which Truth progresses towards that supremacy which we all profess to believe to be her inheritance, if public writers and speakers of every degree would only be careful never to advance statements which cannot be maintained. The smallest of small talk need not be a tissue of falsehoods; and those who pretend to review serious matters might as well give an undistorted picture while they are about it.

Ratepayers and the New Education Act.

THE Education Act will certainly increase the amount of the rates collected in most places, which is not a pleasant thought for those municipal politicians who have acted during the last few years as though the ratepayer's pocket were inexhaustible. These people have plunged into electricity supply, and all sorts of hazardous enterprises, as though their chief object in official life was to leave no pickings for their successors; and now they have to face the necessity for reorganizing the national system of compulsory and assisted education. What a time for all educational "cranks" it would be, if there were no Whitehall to see fair between the ratepayer and the school child! Whatever else it will achieve, the new Act must have the effect incidentally of interesting in education vast numbers of people who have hitherto been content to leave the subject in the

care of the school board or the local committee. If anything like fair value is eventually secured in return for the money spent on elementary schooling, this will be something very much better than the existing system has succeeded in procuring in return for the cost incurred. Instances of the absolute failure of the present system of compulsory public elementary schooling are only too general. We frequently hear of the ineligibility of boys who have passed their standards to perform the simplest clerical work in connection with the routine of a gas-rental or coke office; and yet their schooling has been nothing but clerical. The trouble seems to be usually the same—lack of thorough grounding in first essentials, and ignorance of how to learn what is wanted.

The newspapers occasionally are full of "howlers" perpetrated by unhappy lads in their examination papers; and these woful results, although supposed to be comical, are of much too serious a meaning to be laughed at. It is time for a thorough reconsideration, in the light of thirty years' experience, of the "subjects" that can really be satisfactorily taught in public elementary schools; and how. Most men who have experience of selecting lads for employment have their ideas on this subject; and these ought not to be kept from the world, inasmuch as they are the real tests of the school system. It should not be overlooked that, when the old Elementary Education Act was passed, public opinion was dominated by the doctrinaire intellectualism which was then in the ascendant. It was the age of ideas, separated as much as possible from persons. Mind was worshipped in the abstract; and men were rather at a discount. So long as your educational system or your form of government was up to the accepted philosophical standard, your character and personality did not count for much. Physical force was assumed to have had its day; and the world was to be guided by resolutions passed in public meetings. Whether the strictly proper exclamation in this connection is "Alas!" or "Bravo!" the fact is, all this brand of opinion is now obsolete.

We have recovered our official regard for individual character, as the thing that most matters in the product of any educational or governmental system. What else do we want? That is just the question which representative ratepayers ought not to be unable to answer, in a way. They should at least know what they want themselves; and out of the gathering together of these requirements, a system of education might be devised that would answer better than anything a Spencer or a Huxley could evolve out of his inner consciousness. This is a matter for the new education authorities to look to. The curse of the old system was that doctrinaires shaped it to please themselves. It should be the glory of the new order that the people themselves, having to pay for it, should be consulted as to what purpose the public elementary school should subserve. If it is to continue to be a machine for spoiling the children of good workmen, and turning them into poor, unhappy imitations of the class above them in the social scale, so be it. Only, let the victims know all about it; and let the ratepayers consent to this misuse of their money.

The South Wales Imbroglio.

The representatives of the coalowners and miners in South Wales met on Tuesday last, and once more adjourned; but the meeting was not an unimportant one, as the owners submitted in set form a draft agreement embodying their latest proposals. The men asked for time to consider it, and negotiations will be resumed to-morrow, and, it is hoped, proceeded with continuously till completed—though, judging by past experience, that is all too likely to prove a vain hope. The owners appear to be suffering from a lack of resolution and an absence of any settled policy; for their Chairman expressly stated that the present proposals are to be looked upon rather as a basis for discussion than as being the best terms the owners have to offer. Indeed, the special correspondent of "The Times" hit the nail exactly on the head last week when he remarked that "the whole business calls "up memories of bargaining for horses and cattle at a rustic "fair," and it is open to question whether such a method of conducting negotiations of so important a character is either dignified or expedient.

It is quite certain that the employers do not expect the men to agree to the terms contained in the agreement they have submitted. It is equally certain that, even if the owners had entertained any such expectation, the men have not the slightest intention of accepting the proposals. Embodied in a lengthy agreement, and containing many details, the scheme proposed may be briefly summarized as follows, to enable our readers to appreciate the main points of difference between the two sides. It is proposed that wages be adjusted quarterly by a Conciliation Board of 24 members (the men ask for 48 members), with an independent Chairman not connected with the trade; that the average price of coal be ascertained by joint auditors as at present, and that the selling price shall remain a factor in the determination of wages; that the maximum wages rate shall not exceed 57½ per cent. (the men claim 70 per cent.) above standard; and that the minimum shall be 16½ per cent. (the men claim 40 per cent.) above standard. The draft further provides that the relation of the percentage wages to the selling price shall be adjusted so that the percentage payable in respect of a given price shall be lower than hitherto; also that wages be reduced from 48¾ to 38¾ per cent. above standard from the 1st of March. [These two clauses will be most strenuously opposed by the men, who appear to think, with the Irishman, that the "reciprocity" should be all on one side]. It is proposed that small coal shall be paid for at a nominal rate, in order that the law may be complied with, and that the colliers shall pay for their house coal at present prices, *plus* a percentage equal to the percentage above standard that wages may be—a very fair proposal. The agreement, as drafted, would last for three years, and then be terminable by six months' notice. This, it may be noted, would not enable the South Wales miners to comply with the Southport resolution, to bring all wages agreements to an end next December.

The miners' leaders profess surprise and indignation at being asked to accept such terms—"Mabon" says that they would make themselves appear "ridiculous and incompe-"tent" if they accepted "anything approaching" these proposals; and at to-morrow's meeting their representatives will propose numerous amendments. In the absence of any reliable indication as to how far the owners—who sadly need a leader who knows his own mind and can make up others' minds for them—mean to insist on their proposals, it is impossible to form a certain opinion as to the outcome of the negotiations. The position is difficult and critical; and it can easily become dangerous. But it is not impossible that the men will get substantially the best of it without any stoppage of work. It is, in any event, extremely desirable that a settlement should be come to at an early date; for this lingering uncertainty long drawn out is most unsettling, and renders the arrangement of future business practically impossible.

Labour Politics and Municipalism in the New Year.

It would be something to be thankful for, if with this New Year one could mark the beginnings of a better order of things in respect of the two besetting evils of the British body politic which occupied so much attention last year—trade-restraining Trade Unionism and Socialistic Municipalism. At the risk of being deemed optimistic, we venture to opine that there is actually some ground for the hope that matters are improving in these respects—or, at least, that there is a chance of such an improvement being attempted. The judgment in the Taff Vale case will be the new point of departure, of course, by reason of its message, which the most obtuse can perfectly understand, that the old reign of irresponsible Society tyranny is ended. Henceforward Trade Unions can be held answerable for their acts; and it will soon be seen which of these organizations will survive the sudden blossoming into ripe citizenhood. In all probability most of the non-benefit Unions will perish. Among the older Societies, moreover, the likelihood also is that those which have carried the rule of selfishness to the farthest extreme will not find it so easy as it has been to get their behests obeyed. Whether unconsciously or of set purpose, some of the real tradesmen's Unions have all along cultivated the disease of government known as "class "privilege." It is hardly necessary to point out that this was the evil of feudalism, and was the sole excuse for the French Revolution. It was the essence of the social system which is supposed, erroneously, to have perished in the Revolution, that one person might do what another person might not do. Originally the privileged were the classes of kings, priests, and the aristocracy. It was the members of these privileged classes who might steal all the horses, while outsiders could be hanged for looking over the hedges. Constitutional and popular government is imagined to have changed all that; but, as a French philosopher remarked,

the more things are altered, the more they remain the same as before. That privilege which has been formally denied to princes was informally usurped by plasterers; and the immunity from civil process once enjoyed by cardinals had descended to carpenters.

If the appointed leaders of the Trade Unions were better read in history, they would have been forewarned of the end of this thing. Privilege is not necessarily wrong or bad in itself. Indeed, there is much to be said for it, in theory; and in some respects the world could not well get on without it in practice. But the trouble comes when it is abused, as—human nature being what it is—is sure to happen. The pyramid is sooner or later set upon its apex instead of being left to rest upon its base; and, of course, it topples over. There is no living for the crowd of "exempts," and of the privileged ones, their relations and dependents. The pressure of economic influences comes to bear against the assertion of privilege when—as always occurs in the long run—what began as a pretty social theory gets translated into a demand for an undue share of pudding, of which there is never enough to go round. Trade Union labour was not satisfied with fair treatment; it demanded preference, and finally scorned to deserve it. So long as employment was to be had, its "organization" in the selfish interest of the workpeople was easy enough; and this was overdone, with the natural result. Now the tables are turned; and it is the proud Plasterer who finds the employer necessary to his own continued existence.

The exposure of the inroads of Socialism and self-regarding Labour politics into the domain of Municipalism is believed to be already taking effect. The London County Council have once more had to drop their ambitious scheme for the building of a Municipal Palace which should eclipse the Houses of Parliament in the glory of stone and mortar. Sundry Metropolitan Boroughs that had contemplated following this example have thought better of it. The Housing Committee of the Glasgow Corporation have abandoned their building scheme. It is reported that a scandal of the first magnitude in regard to corrupt Municipalism is about to burst in Dublin. All these signs of the times point to the way of safety and lasting prosperity for the working classes being different from the attractive short cut of class privilege. This is indeed, as all human experience abundantly testifies, "the primrose path that leads to the eternal "bonfire." Yet it will always be reopening in some fresh place, as human weakness ever seeks some new form of unequal and illegitimate advantage over a fellow.

The New Patent Act.

THE Patent Act of last year has been passed over of late by most of the technical journals, for the reason that it was for long in a state of suspended animation, and doubts existed in regard to its chances of becoming law. But at the last moment the Government took care of their bantling, and actually the patent system of this country is in a condition upon which future patentees are to be congratulated. All things considered, the public for which the "JOURNAL" is published are as much interested in the subject of patents, and as likely to be as deeply affected by the methods of the Patent Office, as are any other body of technicians in the English-speaking countries. We have repeatedly discussed these methods; and have always professed the opinion that English inventors would not gain much by an exchange of their national patent system for that of any foreign country. Not that the English system was perfect by any means, but because those who in public speaking as well as in print professed such unqualified admiration of foreign systems always overlooked their imperfections. The new Patent Act aims at the diminution of one of the risks which an applicant for a patent has to run—that of prior publication of his invention. It is enacted that after the deposit of a complete specification there shall be an official examinaton upon it, for the purpose of ascertaining whether the invention claimed has been wholly or in part claimed or described in any previous patent specification for fifty years. If so, the applicant will be informed, and permitted to amend his specification either in the sense of avoiding the prior published matter, or of acknowledging the fact in the specification by way of notice to the public. The period of provisional protection is shortened to six months, which appears to indicate that the three months borrowed from this period will usually suffice for the supplemental inquiries to be made. An additional fee of £1 may be charged in respect of the investigation, payable on the sealing of the patent. No guarantee of any kind attaches to this procedure; nor does any liability accrue in consequence to the Office or to any of the officers of the Department. The Board of Trade will direct by Order when this arrangement is to come into force; and it is not to be retrospective.

It will be perceived that this scheme of limited official examination for novelty of applications, and the distinct repudiation of any guarantee of validity, run directly counter to two of the most hackneyed of newspaper statements respecting the character of the most admired foreign patent systems. If there is one mistake concerning these foreign patent systems more fondly cherished than others by those who write about them in the newspapers, it is that they guarantee the soundness of the patents that are conferred after official examinations. They never do anything of the kind, as those who have had business relations with any of them know full well. The new English system will simply place at the service of all applicants, for a nominal charge, the full knowledge of the official publications of the Patent Office for fifty years which the examining officers may be assumed to possess. This service will not make any alteration in the legal relations of the office to the applicant, or of the patentee to the public. It will have nothing in common with the despotism of (say) the German Patent Office, which can, and often does, refuse patents at discretion; nor will it fall into the hopeless delays of the United States system.

Another section of the new Act relates to the vexed question of compulsory licensing. The arrangement to this end introduced by the previous Act is abolished; and in its place there appears a procedure which is to be set in operation by a simple letter of complaint to the Board of Trade from "any person interested," setting forth that the reasonable requirements of the public with respect to a patented invention have not been satisfied. Hereupon the Board of Trade will consider the petition, and it is evidently contemplated that they will drop a friendly note to the other party, informing him that complaints have arisen; for it is enacted that "if the parties do not come to an arrangement between themselves," the Department may refer the petition to the Judicial Committee of the Privy Council. Where this is done, and the tribunal is satisfied that the public requirements are not satisfied, an order for a compulsory licence may issue, or the patent may be revoked. Here, again, the idea of the Act is not in agreement with the plan of requiring the patent to be actually worked in the country granting it, which is a characteristic of various foreign systems. The Act states that the reasonable requirements of the public are to be the criterion of meritorious use of a patent by the owners. Hence there is no suspicion of protection for a British industry in the new provision, which refers to the interest of consumers only. Failure to satisfy the reasonable requirements of the public within the meaning of the Act is to be inferred where any existing industry, or the establishment of any new industry, is unfairly prejudiced, or the demand for the patented article is not reasonably met. Doubts have been expressed with regard to the working of this latter part of the Act; and it remains to be seen whether the reformed procedure is a real improvement. In all probability, the existence of a means of bringing pressure to bear on recalcitrant patentees will prove sufficient to ensure their acting reasonably.

A Word to Our Readers.

Most of our readers will doubtless remember that some few years ago—to be precise in March, 1899—there appeared in the "JOURNAL" an article entitled "A Link with the Past," which dealt with the late Mr. Edward Heard's connection with the early days of gas lighting, and mentioned the fact that his wife was still living. Mr. Heard was associated with Winsor while he was engaged in the laborious work of establishing the gas industry in London; and it is stated in "King's Treatise on Coal Gas," in the chapter on "Early Attempts at Purification," that "the first patent in connection with this subject was obtained by Edward Heard, who had been the assistant of Winsor, read his lectures for him at the Lyceum Theatre, and afterwards became the rival of his former patron by lecturing on gas in the Provinces." This patent was dated June 12, 1806; and the suggestion was to stratify lime with the coal in the retort, or to cause the gas when produced to pass over lime. The other events

of his life, in relation to gas lighting, were fully chronicled in the article named above; and to this we must refer readers whose memories are short, or who did not at the time read what was then written. These matters are, of course, now ancient history; and Mrs. Heard (though this is not her present name, for she married again) is over 80 years of age—she having become the wife of Mr. Heard 50 years ago. Besides being old, she is unhappily extremely poor; and in our previous article it was suggested that anybody who felt impelled to smooth her declining years with a little help might forward the money to the Editor of the "JOURNAL," who would see that it was applied in the best manner possible. Though no regular appeal for assistance was made in our columns, this hint met with a ready response; and a sum of over £37 was received, with offers of more money should it be needed. The idea was to provide a small pension for the remainder of the old lady's life; and accordingly 4s. a week has been paid to her ever since. Little as this is, it has now more than exhausted the fund at disposal (some £3 having so far been expended beyond what was received); and the opportunity therefore once more presents itself to us of pointing out to readers a way in which they can perform a really kind action. A large sum is not needed; for there is no intention of doing anything more in the future than has been done for the past four years. Any amounts that may be sent to the office of the "JOURNAL," or to Mr. Thomas Berridge, the Engineer of the Leamington Gas-Works (who has taken a great interest, and much trouble, in the matter), will be acknowledged in our columns. While making this fresh suggestion for assistance, we should like to mention that, in a letter written a few days ago, Mrs. Heard expressed her heartfelt thanks to those who have already done so much for her. To restart the fund, we have pleasure in stating that Sir George Livesey has forwarded another £5, with the promise of a further similar amount later on if required.

Trade Unions and their Members.

The harmfulness of the present Trade Union policy, so far as employers of labour and the public generally are concerned, has by this time got to be pretty well known; and hence the lively satisfaction felt with regard to the recent decision in the Taff Vale case, by which it has been shown that the Unions are not altogether beyond the reach of the law. Though, however, these bodies have now been held to be suable for their wrongful acts against third parties, their own members appear to have no legal remedy whatever against them. This is shown by section 4 of the Trade Union Act, 1871 (which, with the amending Act of 1876, contains all the legislative provisions under which Trade Unions are constituted and carried on), in which it is stated that "nothing in this Act shall enable any Court to entertain any legal proceeding instituted with the object of directly enforcing or recovering damages for the breach of any of the following agreements; but nothing in this section shall be deemed to constitute any of the agreements unlawful." As the agreements specified are of the greatest importance to Trade Union members, and the immunity of the Unions from their legal enforcement is not so well known by those interested as it should be, it may be of interest to give them here. They are these: (1) Any agreement between members of a Trade Union as such concerning the conditions on which any members for the time being of such Trade Union shall or shall not sell their goods, transact business, employ, or be employed. (2) Any agreement for the payment by any person of any subscription or penalty to a Trade Union. (3) Any agreement for the application of the funds of a Trade Union (*a*) to provide benefits to members, or (*b*) to furnish contributions to any employer or workman not a member of such Trade Union, in consideration of such employer or workman acting in conformity with the rules or resolutions of such Trade Union, or (*c*) to discharge any fine imposed upon any person by sentence of a Court of Justice. (4) Any agreement made between one Trade Union and another. (5) Any bond to secure the performance of any of the above-mentioned agreements. This is truly a comprehensive list, and worthy of the serious attention of those who are making their contributions to Unions with other objects than that of supporting the suicidal policy of "strike."

And the Need for Reform.

Attention has been drawn to the clause referred to by a writer in one of the Western newspapers, who remarks that, while Trade Union leaders are talking at large about the necessity of legislation to protect their funds, the members of these societies would do well to consider whether their interests as such do not require similar protection. This is a view which is not usually taken of Trade Unions; but it is undoubtedly a sound one. The members—or, it is to be hoped, at any rate the majority of them—contribute their money in the expectation that the pecuniary benefits promised will follow in due course; and so it cannot be too widely known that no Trade Union can be compelled to provide them, however solemnly they may have undertaken to do so. The writer of the article in question states that a fellow-servant of his is at the present time vainly claiming a superannuation allowance to which the rules of his Union profess to entitle him, but which has been refused because he did not see eye to eye with his leaders in a recent dispute. Then, again, he points out that no agreement to discharge a fine imposed upon any person by a Court of Justice is enforceable, "so that, although 'protection' is one of the chief and most alluring baits held out to the working man to surrender his liberty to the keeping of a Trade Union, he has no remedy in the event of a refusal to provide the very protection for which he has paid." As an instance of this, an incident is quoted which occurred during the last Taff Vale strike, when a number of men were each fined £4 for breach of contract. The Union had, before the strike, loudly proclaimed their intention to pay all fines if the men would only go out; but, in spite of this, the men were told, after the strike was over, that they must meet the fines themselves if they could not induce their employers to forego them—which, happily, they were able to do. Not even a bond to secure the disbursement of benefits or fines, or any other payment which a Trade Union undertake to meet, is enforceable at law; so that members are entirely at the mercy of the officials, if they choose to repudiate them. Thus it follows that, though a man may for years pay money into a Union in the belief that he is thereby making provision for sickness, old age, and for those he leaves behind him, he may be cast adrift at any moment at the caprice of the person who happens to have control of the funds, while he is absolutely powerless to recover a penny of the money due to him. "And yet," concludes the article before us, "Trade Unions are the very bodies that most bitterly oppose the formation of shop clubs, provident funds, superannuation funds, and other institutions the members of which have an indefeasible right to the benefits for which they pay, whether their payments are sufficient of themselves to meet outgoings or whether the funds are supplemented and kept solvent by the employers." Though doubtless the Unions generally do their best to carry out all moral obligations under which they may rest, it is surely high time that the machinery of the law was placed at the disposal of the members for compelling them to do so should the necessity arise. Meanwhile, the plain statement of fact in the paper referred to may prevent many men from living any longer in a "Fool's Paradise" with regard to the possibility of legally enforcing undertakings given by the Unions to which they may belong.

WATER AFFAIRS.

Preparing for Action in London.

THE result of the combined efforts of the Local Government Board, a Select Committee of the two Houses of Parliament, the members of those Houses, and the representatives of all the London Water Companies, to settle the much-discussed question of the Metropolitan Water Supply, was presented to the public, through the agency of His Majesty's Printers, on Tuesday last, in the shape of the Metropolis Water Act, 1902. This measure provides, as readers of the "JOURNAL" are aware, for the establishment of a Water Board, "to "manage the supply of water within London and certain "adjoining districts, for transferring to the Water Board "the undertakings of the Metropolitan Water Companies, "and for other purposes connected therewith." The Bill introduced by Mr. Long did not receive the Royal Assent till the 18th ult., so that the Act—one of the last products of the late prolonged session—has appeared with commendable promptitude. It consists of 53 clauses in all, and five schedules; and the third of the latter indicates the method of putting it in force. In the final paragraph it is set forth

that, "as soon as may be" after the passing of the Act, the Local Government Board are to take such steps as are necessary for constituting the Water Board, for summoning the first meeting, and for regulating the proceedings thereat. Accordingly, the Board lost no time in taking the initiative; and simultaneously with the issue of the Act there was published in the London papers a circular dated the 27th ult., signed by the Permanent Secretary (Sir S. B. Provis), directing the attention of the officials of the various authorities concerned to the provisions specially bearing upon the election of representative members of the new body, and ordering the appointments to be made at a meeting to be held within two months from the 24th ult., or such further time as may be allowed. The order enumerates all the constituent authorities, and indicates who are disqualified from representing them. It does not apply to the grouped Councils, who will be dealt with separately. This prompt action of the Central Board allows the New Year to open with the way clear for the next step in these proceedings.

The Water Board, it may be remembered, is to be composed of a Chairman, a Vice-Chairman, and "other members." In the Bill as introduced, the number of the latter was 67; but when it left the Joint Committee this had been increased to 71. The scheme was subsequently remodelled, and brought to something like its original proportions. By a re-grouping of the districts, the London County Council were given an additional four members; but, on the other hand, the Conservators of the Thames lost two, and the representative is to be appointed by the County Councils of Gloucestershire and Wiltshire, of Oxfordshire, Berkshire, or Buckinghamshire, or of Oxford or Reading. Subject to this, the members of the Board need not necessarily be members of the constituent authorities, but may be appointed from outside these bodies. Nevertheless a member of a Council who is the chosen representative of that body, has to relinquish his position if he ceases for two months to be upon the Council. Under the original scheme, the first Chairman and Vice-Chairman were to be selected by the Board; but subsequently this duty was left to the Local Government Board. In the Bill as passed, however, the first arrangement stands.

The new Board will be undoubtedly large; but the difficulty which faced those who had to constitute it was to make it smaller with due regard to the adequate representation upon it of all the interests concerned. It was this very difficulty which presented itself to Messrs. Stevenson and Burstal, when they were considering the subject ten years ago. In their pamphlet published at the time, they suggested the formation of a Water Trust as one solution of the problem (the alternative being an amalgamation of the Companies); and they recognized that upon such a body the London County Council, the City Corporation, "and the various County Councils, if not each Urban or "Rural Sanitary Authority within the district of supply," would require, or at all events would attempt to obtain, representation. To proceed to the election of a representative Board on this basis would, it was thought, be productive of an "unwieldy body." Consequently, taking as their model the case of Stockton and Middlesbrough, they submitted that a very powerful and representative Board, which would "command the confidence and respect of the "public," could be chosen from the City Corporation, the London County Council, the Councils of counties within the Companies' limits of supply, and the Conservators of the Thames and Lea. This scheme certainly furnished a simple solution of a great problem. But since it was put forward the Metropolitan Borough Councils have come into existence; and these had to be reckoned with. The changed conditions seemed to call for the constitution of a larger body than the one contemplated by the gentlemen named. The Government have constituted such a body, and in a few months it may be expected to have taken definite shape. Whether or not it will prove unwieldy, is a question which must be left for time to answer.

New Gasholder at Amsterdam.—A gasholder of 3,530,000 cubic feet capacity is now being erected at Amsterdam by the firm of Aug. Klönne, at whose works at Dortmund the lower curb and first tier of plates are now laid out. The bottom plates are 16 feet by 10 feet, and $\frac{3}{8}$ inch thick. The side-sheets are 31 ft. 6 in. by 4 ft. 6 in., and $1\frac{1}{2}$ inches thick, and weigh about 3 tons. The joints of the plates are made with double fish-plates—those of the side sheets with eight rows of rivets, and those of the bottom plates with four rows.

ESSAYS AND REVIEWS.

THE HONORARY MEMBERSHIP OF THE NEW INSTITUTION.

We are glad to receive the following letter from Mr. H. E. Jones, because as a member of the Council of the Institution, he has been closely identified with their proceedings in connection with the matter about which Sir George Livesey wrote in his communication published last week; and it will be, we have no doubt, a matter for gratification on the part of those who may be of the same opinion as Sir George on this particular question to have Mr. Jones's assurance that he has "not the slightest fear of the prestige of the new Institution not being fully and heartily maintained." We must, however, protest against our correspondent's reading of the few lines which prefaced the letter in last week's issue. It was not in any way suggested that there "would not be wisdom in the action of the Joint Council"—the view which we wished to convey, by slight allusion rather than by pronounced statement, being that the Council were quite capable of acting justly without the intervention of the advice of counsellors personally interested in Clause 4 and Article 8 of the new Memorandum and Articles of Association. The words used by us appear to be quite clear; and there does not seem to be any ambiguity about them to justify an interpretation different from the one intended. Of this we are sure that, though Mr. Jones was unable to see in them without a little elucidation their intended purport, there are men to whom they are perfectly plain. Our correspondent of last week did not come into the category of "interested counsellors;" and therefore his letter was published. But now we have to charge Mr. Jones with a little obscurity as to the exact signification of his statements. He asserts that the postscript "to Sir George Livesey's letter is written under some misapprehension;" but he does not say wherein the "misapprehension" lies. If what follows is intended by Mr. Jones to throw light on the point, then it has failed in its intention so far as we are concerned. As to the last paragraph of Mr. Jones's letter, we are also in a cloud regarding the latter portion. But perhaps the "third quarter" will recognize himself or themselves. We do not think Sir George Livesey will suggest that there can be any miscarriage under the rules *as they now stand*. The point of his postscript is that the articles bearing upon the matter in question are a radical departure from the resolution as passed by the Institution in May last. But he will doubtless make his position clear on his own account.

Sir,—I cannot pass in silence the suggestion of your introduction to Sir George Livesey's letter, that there would not be "wisdom" in the action of the Joint Council.

I venture to say that, when the result of the ballot is ascertained, you will see that this suggestion was unfounded; and that Sir George Livesey will be convinced that there was no room for the misgivings to which he has given such lengthy expression.

I doubt if half of those whom we all would like to see in the honoured class will be found in the list, because unfortunately some of them have refrained from applying.

The postscript to Sir George Livesey's letter is written under some misapprehension. When the rules had to be legally framed upon the resolution, and the practice formulated to follow the resolution, two things were found to arise: First, that the members of the dissolved Institutions should be invited to re-apply, which they have done, and been duly admitted to a very large number (nearly seven hundred), and besides this some of the former members who were not eligible to the ordinary classes, also applied. Then there came the necessity for submitting each to the ordeal of the two-thirds majority vote. But it by no means follows that because, through their own action, the list was necessarily a long one, as a "sequitur" they must all be elected.

From first to last, when the Joint Councils met, it was clear that the majority of both Councils were animated by the same professional spirit, and by the same courage to defend the action they might take to maintain the prestige of the new Institution against the attack of possibly disappointed candidates. When the ballot is declared, it cannot contain the names of some of those mentioned, because there were no applications from them; but there is nothing to prevent at any time an application being received and voted upon under the terms of the resolution of which (as it has been eminently successful) I am proud to have been the author.

I will conclude by saying, from what I have seen of the whole of my colleagues on the Joint Council, I have not the slightest fear of the prestige of the new Institution not being fully and heartily maintained.

It may appear superfluous for me to express this; but I have heard with some concern that the danger of miscarriage through want of judgment on the part of the Council has been almost hysterically deplored in a third quarter, where I should have expected more moderation and respect for those on the Council.

Jan. 1, 1903. Hy. E. Jones.

RAMPANT MUNICIPALIZATION IN ITALY.

THERE has been a great stir lately in the Press and on the public platforms in regard to municipal socialism as it at present exists in this country; and, in view of this, one wonders what would be the effect of the introduction into the House of Commons of a measure for the permissive municipalization of public services such as that passed, on the 6th ult., by the Chamber of Deputies in Rome, by 156 votes to 81. The agitation over the Education Bill, and the great talk over the transference of the Metropolitan Water Companies to a Public Board, would be insignificant in comparison if a Bill of the kind were even suggested here. The Italian Municipalization Bill (which has yet to come before the Senate, but that will be a pure formality in view of the large majority by which it was passed by the Chamber of Deputies) confers on all the municipalities in the country the power to purchase any public service—gas, water, electricity, tramways, and so on—without doing anything more than give a year's notice, comply with the conditions which we will hereafter quote, and pay compensation somewhat cumbrously defined, though more advantageous than was at first proposed. It is questionable whether any parallel to this in the way of socialism and compulsory expropriation can be found in the history of any country. Here in Great Britain, the proprietors of every privately owned public service have the right, on a purchase proposal, to have the merits of the case thoroughly examined; but, under this Bill, the owners of property in the nature of a public service in Italy are practically voiceless. Contracts and concessions are of no avail, excepting in so far as they assist in the determination of the amount of compensation to be paid to the holders. The municipalities are to have the power to acquire; and the basis of acquisition is already settled. Over this there can be (unless, which is an unlikely event, the Senate can be moved into action) no further question; and so it will be a General Law. The only defensive step that can be made is to take advantage of the power of appeal against an award as to value; but this is a shadowy consolation, as appeal means great delay and expense. There are several gas-works in Italy in which huge sums of money from this country have been invested. We may instance the works of the Continental Union Gas Company, of the Union des Gaz, of the Tuscan Gas Company, the Malta and Mediterranean Gas Company, and of the Cagliari Gas and Water Company; and therefore there is no necessity to excuse ourselves for devoting attention to this unique piece of legislative work, the astonishing character of which is sufficient to interest even those who have no monetary concern in the privately owned enterprises of the country.

When referring to the question of this Bill on a previous occasion, we had not had the advantage of seeing the measure as passed by the Chamber of Deputies. But Mr. A. F. Phillips, M.Inst.C.E., who is closely associated with Italian gas affairs, and who has worked strenuously through the Foreign Office of this country to obtain fair and proper compensation for shareholders who have invested money in undertakings in Italy, has kindly complied with a request made to him for a translation of the measure as passed. From this, we find that most of the articles are uninteresting, and merely of administrative importance. But the one with which investors of capital in Italy come directly in touch is that setting forth the terms under which privately-owned concerns may be taken over; and of this (Article 25) the following is a free translation:—

> Municipalities may avail themselves of the option as by Article I. in reference to the services which have already been given to private industry, when from the actual beginning of the exercise one-third of the whole duration for which the concession was made has elapsed. However, the municipalities have always the right of taking over after twenty years have elapsed from the actual beginning of the operations; but in no case can this rule be applied before the conclusion of ten years.
>
> Should the municipalities not avail themselves of the option of buying out at the periods above stated, they cannot avail themselves of the power except a period of five years has expired, and so on from five years to five years. The acquisition must always be preceded by a notice of one year.
>
> When municipalities proceed to acquire, they must pay to the concessionaire an equitable indemnity, in which the following data are to be taken into account.
>
> (*a*) Industrial value of the installation and relative moveable and immoveable material, taking into account the time expired from the actual beginning of the exercise, and of the subsequent repairs carried out in the installation or in the property, and also taking into consideration the terms which may be contained in the contract of concession as to the ownership of the said property on the expiration of the said concession.
>
> (*b*) Advances or subsidies given by municipalities, as well as the amount of the proportionate tax of registration advanced by the concessionaires and eventual premiums paid to the municipalities granting the concessions, still taking into account the data as fixed by the previous letter.
>
> (*c*) Profit which the concessionaire will lose owing to the acquisition, which must be calculated at the actual value which they would derive, on the same day of taking over, at the rate of legal interest; such annuities (equal to the average of the industrial profits of the last five years) to be multiplied by the years for which the concession has still to run, provided such number of years does not ever exceed twenty.
>
> The amount of such annuities to be calculated on the average of the net profits as returned for income-tax assessment of the last five years, taking out from the same amount the year of the higher and lower profit, and deducting the interest of the capital represented by the amount to be allowed to the concessionaire in accordance with the data contained in letters "*a*" and "*b*" of this article.
>
> The amount of the indemnity may be determined in agreement between the parties, with the approval of the Administrative Provincial Giunta and Royal Commission.
>
> Failing this, it shall be decided, in the first instance, by a College of Arbitration, composed of three arbitrators, one of whom shall be appointed by the municipal council, one by the concessionaire, and one by the tribunal in whose jurisdiction the Commune is placed.
>
> If their award is not adhered to, the municipality, as well as the concessionaire, may appeal to another College of three arbitrators, who shall be appointed by the first President of the Court of Appeal; and they will decide as amicable compositors.
>
> Municipalities who avail themselves of such acquisition shall also assume the contracts of assets and liabilities of the concessionaire entered into with third persons in reference to the industry or service, as well as with the staff employed in the business, provided the contracts have been stipulated and the staff engaged before the notice as by the third paragraph of this article. However, the liabilities derived from such contracts shall be taken into account in fixing the indemnity to be paid for taking over.
>
> The dispositions of this article, except those which refer to the terms of taking over, are not applicable when the conditions of the same taking over or of the resolution of the concession have been fixed by the contract, provided this has been stipulated six months before the promulgation of the present law.

Now this comprehensive clause is a considerable modification of that first proposed; and, as will be seen on comparison, the menace to vested interests has been, by its remodelling, largely discounted. While the principle of the whole Bill is distasteful, the proprietors of Italian enterprises will be truly thankful for the small mercies vouchsafed, which constitute the reward of the steps that the Union des Gaz and the Continental Union Gas Company took through the French Foreign Office, Mr. Phillips on the part of the Tuscan Gas Company through the English Foreign Office, the representations made by the Ministers of other countries to the Italian Government on behalf of the interests that they represent, and the work of the Committee appointed by the Italian Gas Association. It was fully realized by those who moved in the matter that, while they and those they acted for had invested their money in Italy, they had no right to object to any General Law the Legislature might pass, but still they considered—and rightly—that they were justified in resisting provisions in such a law that would deprive them of their property without giving them a proper compensation. The extent to which they have been successful is seen by comparing Article 25 with that as originally proposed. In the first place, it is noticed that municipalities cannot avail themselves of the Act unless the industry proposed to be acquired has been running for at least one-third of the concession. In the original Bill, it was only one-fourth. Then, again, it will be observed that municipalities have always the right of taking over an undertaking after twenty years have elapsed from the commencement of operations; but they may not in any case acquire before the conclusion of ten years. In the original Bill, the periods were fifteen and five years respectively. The moveable and the immoveable materials have now to be taken at the "industrial" value; and the profits are to be multiplied by twenty years instead of fifteen. To show exactly what was formerly proposed, so that readers may make their own comparisons, we reproduce Article 25 (as originally drafted) from the report of the Commission on the taking over of the public services. It was as follows:—

> The municipalities, in spite of any term or condition to the contrary, may avail themselves of the option granted to them by Article 1 in reference to the services which, at the date of the promulgation of the present law, are already entrusted to the private industry, provided from the actual beginning of exercise one-fourth of the whole duration for which the concession was granted has expired. At any rate, however, the municipalities have always the right of taking over after fifteen years have passed from the actual beginning of the exercise; but in no case can this rule be applied unless five years have elapsed.
>
> When the municipalities intend to avail themselves of the option of taking over, they must pay to the concessionaire an equitable indemnity, taking into account the average resulting from the following data.
>
> (*a*) The value of the moveable and immoveable material have at the moment of the taking over, taking into consideration the terms contained in the concession as to the property of the said material on the expiration of the concession.
>
> (*b*) Profit which the concessionaire is going to lose owing to the taking over, which is valued by multiplying the average of the net profits which have been obtained in the last five years, and as returned for the income-tax assessment, for the number of years the concession still remain to run. Such multiplication, however, in no case can be made for a number of years greater than fifteen.
>
> The amount of the indemnity may be determined in agreement between the parties, with the approval of the Administrative Giunta Provincial and Royal Commission. Failing this, it shall be decided by an Arbitration College composed of the President of the Court of Appeal, in whose jurisdiction the Commune is placed, and of two Arbitrators, appointed one by the municipality, and one by the concessionaire. The Arbitrators to decide as amicable compositors.
>
> The commune to have the option of paying the indemnity

within a year from the day on which they actually take over the works, corresponding in the meantime the legal interest.

Unquestionably, in comparison with this article, the one as passed offers a larger measure of protection for vested interests; and for this the thanks of the proprietors of capital invested in Italy are due to those who have worked to secure an amelioration of the originally proposed terms of purchase. At the same time, as we shall presently show, all danger and anxiety have not been by any means eliminated by the improvements effected.

The articles referring to the conduct of the undertakings subsequent to their acquisition have no concern for our readers. But, *inter alia*, it is noticed that, after a municipal council have decided to acquire and undertake a service, the project has to be submitted to the Provincial Giunta, and finally to a Royal Commissioner. If he approves it, it has to be put to the vote of the electors, and, failing a favourable decision, must be postponed for three years. It is also enacted that the municipality must arrive at the price to be paid for the works before the scheme is submitted to the decision of the electorate. If municipalities hereafter grant concessions for any of the services mentioned in the Bill, they must reserve the right of purchase on conditions not more onerous than those contained in Article 25. But this provision, we rather fancy, is almost superfluous; for, notwithstanding the safeguards now provided, the existence of this law will assuredly operate against the investment of foreign capital in Italy, and this the country can ill-afford to lose. "Once bitten, twice shy." The foreigner with money to invest is not likely in future to sink it in Italy, but will turn to other countries to find for it useful employment.

It must be remembered that a municipality can, under the Bill, exercise their option every five years; the basis of the purchase being the profit returned for income-tax for the previous five years. It is not difficult to see the liberty and opportunity that this provision gives the municipalities; and how it will operate adversely to proprietors. There will always be the danger of a municipality buying—and they will not be slow to see this advantage—when the profit of the concern may have been reduced through abnormal causes, such as dear coal and freights, labour troubles, &c. While also it is granted that the provision for an appeal from the decision of the first College of Arbitrators to a second one (who will have before them the motives of the first Court for their decision) is in a measure a protection, the fact cannot be lost sight of that arbitration in Italy is not regarded by those experienced in it as an altogether satisfactory process. The concessionaire appoints one arbitrator, the commune one, and the President of the tribunal in the same commune the third. Thus, in a sense, there are two against the concessionaire; and is it, under such circumstances, difficult to see which way the award will go? Certain it is that every award will be carried to appeal. If the award is below what the concessionaire requires, he will go to appeal at what seems likely to be great delay and expense. On the other hand, if the municipality consider the amount too high, they will go to appeal, but at less expense. There seems to be a glorious time in store for lawyers and advocates in Italy, unless wise counsels prevail, and friendly bargains can be made independent of outside aid. Observed from any point of view, it seems to us that the best course a company can pursue, when a municipality desires to purchase, is to essay an amicable understanding. If the authority are prepared to pay an amount approaching the value of the property, it will undoubtedly be well to accept it, without being subjected to the uncertainty of legal proceedings. Otherwise, if friendly overtures do not avail, and if reason does not prevail on the side of the buyers, then the concessionaires, having used their best endeavours, cannot be blamed if they show to them a strong militant side.

By what is here written, we think it has been shown that the measure is, as previously described, a unique one; that the interests involved are many and large; and that the Bill opens up a condition of things that cannot be to the ultimate benefit of the country. For these reasons, we have been led to examine the provisions at greater length than was originally intended. While, as seen, the modifications made are important, and in a degree satisfactory, there is still sufficient in the one-sided character of the enabling powers of the Bill to create some little apprehension as to the future.

THE COAL QUESTION IN 1902.

THE "coal question," which was debated at so much length and to so little purpose in the newspapers and periodicals during 1900 and the first half of 1901, did not occupy a prominent place in public discussions in the past year, except for a week or two in the autumn, when the miners' strikes in America and France were attracting general attention. Nevertheless, the year that has gone has been far from devoid of matters of interest and moment to buyers of coal on any extended scale; and those matters have not been by any means wholly satisfactory to such buyers. The price of coal has remained, and for the present does remain, too far above its level in previous years of normal trade; and an industry, like the gas-making industry, which depends for its prosperity largely upon the cheapness of coal, cannot cease to take the closest interest in everything affecting the cost of production or the market value of that mineral. In 1902, circumstances combined to influence both to the detriment of the buyer; so that the further fall in prices which would have been witnessed in the later months of the year had trade taken its normal course and no special circumstances arisen, has not yet taken place.

The coal market has been affected adversely, from the buyers' point of view: (1) By the output being kept down (we do not think it will reach the record of 1900 by two or three million tons), as a consequence partly of local strikes and partly of indifferent working by the miners; (2) by the increase in the coal export trade, consequent upon an abnormal demand from America and France; (3) by the increased exports of iron and steel, due to the shortage in the United States; and (4) by the unusual coldness of the summer months. The principal checks to the output arising from labour disputes, were those caused by the strike of colliery "boys" in the Federated districts when wages were reduced in accordance with the award made by Lord James of Hereford, which kept about 30,000 men idle for weeks; the strike at the Denaby Collieries, which began at the end of June, has diminished the output there by about 250,000 tons, and still continues; and the numerous short stoppages at collieries where the non-Unionists were required by their Unionist brothers-in-freedom to toe the mark or quit. Apart from actual stoppages, the output has also undoubtedly been checked, of set purpose, by the men—to try and bolster up the wages-rate—and, in some cases, by the owners, who have preferred keeping up prices to entering upon the task of getting wages lowered. In the Federated districts, indeed, no move was made towards a reduction in wages until the end of May, in spite of the fact that they stood at the maximum up to that time, while in all the other coalfields large reductions had been effected; and then, as we have said, trouble ensued.

The year ended with threats of labour troubles, in both the Federated districts and in South Wales. The Federated owners are asking for a reduction; the miners for an increase; and the Arbitrator is making investigations before he determines his award. In Wales, negotiations which have been going on for months are approaching a crisis; so that the New Year opens with much uneasiness there and in the Midland Counties. As the annual conference at Stockport last October decided that an attempt should be made at the end of 1903 to obtain better terms all round, and to arrange for one huge Conciliation Board to determine miners' wages throughout the Kingdom, the year bids fair to end no more promisingly, so far as labour troubles are concerned, than it is beginning. Fortunately, "clouds" in the coalfields are not invariably followed by storms.

Much interest has centred in American coal affairs during 1902; but for a very different reason from that which caused attention to be paid to them by English coal buyers in 1900 and 1901. Then, the question was whether the English market could be materially relieved by the influx of coal into Europe, if not into England. Recently, it has been the extent to which the efflux of English coal to America would affect the market adversely to the buyer—and that it has so affected it, and is continuing to do so, is only too patent. The consolation is that the present position of affairs can only be a temporary one; the fear is that it may last long enough to frighten consumers into making contracts at unjustifiably high prices. The gas industry ought to get a material reduction in contract rates next year—9s. a ton f.o.b. Tyne is much too high a figure to pay in normal times; and we believe that, with the exercise of a reasonable amount of skill and astuteness, such a reduction will be obtained.

Apart from the influence of the miners' strikes in America and France, the exports of coal—taking all shipments, whether as "bunkers" or coal for sale, into account—were well maintained; the extremely favourable condition of the freight market (which was seriously depressed for the greater part of the year) fully counteracting the adverse influence of the coal-tax. The total shipments for 1902 will certainly be found, when the statistics are published, to have established a record. They cannot have fallen far short of 60 million tons. The Coal Commission of 1866-71 estimated the exports to remain constant at 12 million tons per annum—a figure which is now considerably exceeded by the "bunkers," which the steamers ship for their own use, apart altogether from the sales to foreign consumers. It is to be hoped the Commission at present considering the coal question will get somewhat nearer the mark in its forecasts.

With this evidence of the truth of the saying that "prophecy is the most gratuitous form of error" before us, we might well be excused from attempting any kind of forecast for the ensuing twelve months. But we will risk affording still further evidence to the same effect by saying that, if we were gas managers, we would rather buy our annual requirements of coal next August than in March or April, judging by the present state of affairs. The coal trade has been extremely fortunate in a constant succession of exceptional events that have enabled it to keep from sinking to the bottom of the trough after being on the crest of an unusually big wave; but that the "evil day" will be much longer warded off for them we do not believe.

A communication has lately been made to the Academy of Sciences of Paris, by MM. Seyewetz and Biot, on a new method for the chlorination of aromatic hydrocarbons. The reagent used is the double compound of ammonium chloride and lead tetrachloride. By its aid, chlorine derivatives of benzene, toluene, xylene, naphthalene, and anthracene were readily obtained.

ELECTRIC LIGHTING MEMORANDA.

Double Fatality from Electric Lighting Current at Fulham—Nature of the Occurrence—The Wisdom of Suffering Accidents—The Inquest.

By a coincidence quite striking enough for special remark, at the time when we were commenting in our "Retrospect" for the year 1902 on the persistent increase of fatalities caused by electric traction and lighting currents, another case of the kind was transpiring, at the Fulham Public Baths. Two men went into cubicles in this establishinent on the evening of Tuesday, the 23rd ult., and never came out alive. It appears that they must have come into contact with part of the metal framework of the partitioning, which had somehow become charged with electricity from the lighting circuits, receiving fatal shocks. The evidence given at the inquest showed that there was a good deal of vagrant electricity about the structure of the baths on this particular evening, as several other men who were in the place at the time (including the Superintendent) felt shocks on touching the framework of the cubicles. The lighting current was at 200 volts; and obviously the conditions in this case were peculiarly favourable to the making of excellent contacts between a charged conductor and the wet skin of a bather. After the circumstances attending the deaths had been narrated, the Coroner adjourned the inquest to Saturday last, for the attendance of the Home Office Inspector and the preparation of such expert evidence as might explain the facts. But the facts, though they may be explained at any length, cannot be altered. Two men were killed; and the electric lighting current was the cause of their death. So much is true and incontrovertible.

The "Electrician" observes that "all electrical engineers will read with regret" the story of this fatal accident; but it is open to be remarked that the regret will not be confined to the electrical trade. No one will desire to lay an excessive share of blame for so deplorable an illustration of the hidden dangers by which the life of man in a high state of civilization is environed, upon the immediate cause of mischief in this instance. Most probably nobody can be blamed for anything that was done or omitted in respect to the electric lighting of the Fulham Baths; and it may be supposed that the affair of the 23rd ult. was as purely accidental as if the victims had been run over in the street outside. Yet as a matter of fact, what happened was the result of many things brought into a concourse of causes and influences which will have to be carefully and thoroughly investigated if greater security against a repetition of such casualties is to be obtained. And some of these things have occurred before. They are continually occurring in all sorts of places; and it will only be natural if the public begin to think that the benefits and the blessings of a general distribution of strong electric currents indoors and out are heavily discounted by the attendant risks. The most disturbing feature of these electrical accidents consists in the impossibility of foreseeing or guarding against them. The public will never rest satisfied with such a condition of things electrical that, as was manifested at the Fulham Baths, an entire public building may be charged with the potentiality of giving death on touching a part of it not obviously perilous, and nobody shall know there is anything amiss until somebody is killed.

This, it appears to an impartial observer, is the true "moral" of these electrical fatalities; and therefore in a sense they are of overwhelming importance for those who follow the trade. It does not yet appear that members of the electrical profession adequately realize the peculiar seriousness of that quality in electrical accidents which may be designated their mysteriousness. It does not do to put off the thought of this aspect of the matter by referring to the inevitability of "accidents" in all human affairs. There is a profound truth in what is commonly ascribed to successful leaders of men and supreme directors of events, as Lord Kitchener—that they will not forgive accidents. Most of the so-called accidents of life are nothing else than stupidities, ignorances, and the direct consequence of carelessness, want of foresight, and weakness. Nobody knows this better than men of the type of the ever-victorious general. The ordinary phraseology of the verdicts of coroners' juries as to causes of the fatalities that come before them should be understood with regard to its legal significance, rather than as a rigid interpretation of the evidence. A finding of "accidental death" is, in most instances, no more than a merciful, even a weak, acceptance of the truism of the liability of men to err, on the part of other men who feel their own feebleness. There are occasions, however, when what is in question is not a matter of common human stupidity—as of the perennial idiot who "did not know it was loaded," although even here it may be doubted whether the fool ought to go scot free—but of the sleeping of a sentry at his post in the advance of human enterprise into the debateable land where Nature is the implacable foe of those who are not yet her masters. We do not, of course, imply any particular application of this general observation; but it is quite certain a too easy consenting to the occurrence of "accidents" is not the way to render them scarcer.

Since the above was in type, the inquest has concluded, and the verdict is substantially in accord with the tenour of our reflections. In finding that the deaths were accidental, the Jury refer them to "faulty design and construction of the installation," without fixing blame upon any person for this state of things. This declaration amounts to an indictment of the whole practice of this class of work, as usually carried out; for it is to be understood that nobody concerned was wishful to bring discredit upon electric lighting. One of the expert witnesses called expressed the amiable hope that the occurrence might not bring electric lighting into disfavour; but the truth is that interior wiring is already a more than sufficient bugbear for this interest. The question of cost is in all cases a formidable one; and it was not made easier by the statement offered in evidence, that for a few additional pence per cubicle the lighting of these baths could have been made as safe as possible. When the public understand that the expense of wiring a house for electric lighting covers a question of life and death, as well as touching the pocket, trade in this department of industry will not tend to expand more rapidly than it has done in the past.

GAS BILLS FOR 1903.

The following Bills relating to Gas Supply in the United Kingdom have been deposited in the Private Bill Office, and will be proceeded with during the ensuing session of Parliament. According to custom, we first notice the leading provisions of the Bills proposing to incorporate Gas Companies.

The Billingshurst and District Gas Bill rehearses in the preamble that there is no adequate supply of gas in the parishes of Billingshurst, Wisborough Green, and Pulborough, in Sussex, and the parts adjacent. A Company is to be incorporated for providing a supply of "all kinds of gas for lighting, heating, motive power, and other purposes," with a share capital of £15,000 and power to borrow £5000. The maximum price of 14-candle gas is to be 5s. 6d. per 1000 cubic feet. The ordinary model clauses are reproduced in the Bill, with the addition of a clause dealing with slot-meter supplies, which proposes that the Company shall not be deemed to have received the money paid by means of such meter until their collector shall have collected the same—any deficiency to be made good by the consumer. Power to apply for an Electric Light Order or licence is asked for. The site of the gas-works is to be at Wisborough Green.

The Bridgwater Gas Bill is described as a Bill for "continuing" the Bridgwater Gaslight Company, who have an Act passed in the fourth year of William IV. As it is proposed to repeal this old Act altogether, the present Bill may be properly regarded as a scheme of incorporation. The Company have largely exceeded their original capital powers, both by calls upon the shareholders and appropriations from the profits, until by 1883 their capital employed was written in the Company's books at £18,000. Since that date, there has been continued expenditure on the works out of profits, amounting to £19,896—making together the sum of £37,896 expended on the undertaking; and the working capital of £5500 was similarly obtained. A structural valuation of the property amounts to £37,240. The net earnings of the Company for the last five years have amounted on the average to the sum of £3290 and upwards annually. The old Act does not limit the rate of dividend payable, nor fix the price or the illuminating power of the gas. The limits of the district are to be the borough of Bridgwater, and so much of the surrounding parishes as lies within a radius of 1½ miles from the borough Market House. The capital of the Company is to be £84,000; being the aggregate of £18,000 called the original 10 per cent. capital, a 5 per cent. improvement stock of £24,000, and £42,000 in new 5 per cent. stock. In addition to an existing mortgage debt of £1300, the sum of £12,700 may be borrowed on the original and improvement stocks, besides one-third of the amount of the additional capital. Power is sought to declare interim dividends. The members of the Committee of Management appointed under the old Act are to be continued as the first Directors of the Company. Additional gas lands and powers of severance are required. Public lamps are to be supplied at the lowest price charged for the time being to any private consumer. The standard price of 14-candle gas is to be 3s. 9d. per 1000 cubic feet, tested on the works or within 200 yards thereof. Consumers' fittings may be specified. Discounts not exceeding 15 per cent. may be allowed to consumers. A saving clause is inserted on behalf of the Corporation.

The Burgess Hill and St. John's Common Gas Bill is to incorporate a limited Company formed in 1867 for the supply of a district situated in the parishes of Keymer and Clayton, Sussex. The share capital of the limited Company amounts to £7800, with a loan of £3500. The gas-works are situated at Burgess Hill. The district of supply is to be defined. The purposes of the Company include the manufacture and supply of "gas for lighting, heating, motive power, and other purposes to which gas, whether manufactured from coal, slack, or other substance or liquid, may be applicable." The existing share capital is to be made original capital of the Company, and to be supplemented by £13,200 of additional 7 per cent. (or 5 per cent. if preference) capital, with one-third loan. The maximum price of gas is put at 6s. per 1000 cubic feet. Illuminating gas is to be of 14-candle power; but "power gas need not be of any illuminating quality." Consumers may be allowed discounts up to 10 per cent. Pipes may be used for ancillary purposes. Consumers' fittings may be specified.

The East Ardsley Gaslight Bill is to incorporate a Company

formed in 1871 as a limited Company, for the purpose of supplying the parish of this name, in Yorkshire. A Provisional Order was obtained in 1872, which provided that the share capital should not exceed £6000; but no restriction was imposed on the amount of borrowed money. The Company have, by special resolutions, increased their capital to £12,000, and have also borrowed £1200. The whole of this share capital has been issued in £1 shares, and is fully paid up, and the money properly applied. The order of 1872 is to be repealed. The capital is to be increased by £1200 in 7 per cent. shares, with one-third loan. The standard price of 14-candle gas is to be 5s. per 1000 cubic feet. In testing for illuminating power, the gas is to be burnt at such rate as to yield the maximum light for which such burner is designed. Consumers' discounts up to 20 per cent. may be allowed. Consumers' fittings may be specified.

The Market Drayton Gas Bill is to incorporate a Company formed in 1861, whose capital now amounts to £4800, with £500 borrowed on mortgage. The limits of supply are to be such part of the parish of Market Drayton, otherwise Drayton-in-Hales, as lies in the County of Salop and to the west of the Shropshire Union Canal. The capital of the Company is to be increased to £25,000, with one-third loan. Additional gas lands are required. The maximum price of 14-candle gas is to be 5s. per 1000 cubic feet. Discounts are to be allowed, of not exceeding 10 per cent. for prompt payment, and 20 per cent. for large consumption.

The Nantwich Gas Bill is to incorporate a limited Company, formed in 1869, with a present capital of £5000 in 5 per cent. preference, and £12,000 in ordinary shares. There is also a debt of £7000. The district of supply is defined. The capital is to be increased to £40,000, with one-third loan. In the sale of additional capital, an equal tender by a shareholder, consumer, or employee of the Company is to have the preference. The standard price of gas is to be 4s. per 1000 cubic feet; and the quality, 14 candles. Consumers' fittings may be specified.

The Wellington (Salop) Gas Bill is to incorporate a limited Company formed in 1851 under the name of the Wellington Coal and Gaslight Company. A Provisional Order was obtained in 1872. The original capital under this Order amounts to £12,000, to which there is added £9000, and a loan of £4000 at 5 per cent. The limits of the district are defined. The supply of gas is to be for the purposes of "lighting, heating, motive power, and all other domestic, trading, public, and other purposes within the limits." The capital of the Company is to be £60,000 ordinary stock, whereof £23,400 is additional capital, with one-third loan. In the clause defining the application of the premium capital, it is provided that the expense of the issue is to be deducted from the premiums received. (This is the case with several Bills, but is not universal.) Employees' and consumers' equal bids are to be preferred. The existing perpetual debenture stock of the Company is to be redeemed by being exchanged either for new ordinary stock or for new debenture stock, by agreement sanctioned by a general meeting. The standard rate of dividend on all the capital is 5 per cent. The Directors may, if they think fit, annually appropriate, out of the revenue of the Company, and as part of the expenditure on revenue account, any sum not exceeding 1 per cent. on the paid-up capital of the Company for the time being, to form a renewal fund. This fund may accumulate until it amounts to a sum equal to 10 per cent. on the paid-up capital, and not exceeding £5000, provided that when the fund reaches this sum the interest is to be carried to the credit of the fund available for dividend. The initial price of 14-candle gas is to be 4s. per 1000 cubic feet, with not exceeding 10 per cent. discount to consumers in consideration either of prompt payment or large consumption. Consumers' fittings may be specified. Interest at the rate of 4 per cent. is to be paid on consumers' deposits. A special clause deals with injury to meters. Every person who wilfully, fraudulently, or by culpable negligence injures, or suffers to be injured, any pipe, meter, or fittings belonging to the Company, or who fraudulently alters the index to a meter, or prevents a meter from duly registering the quantity of gas supplied, is (without prejudice to any other right or remedy for the protection of the Company) to forfeit and pay to the Company a fine not exceeding £5; and the Company may, in addition, recover the amount of the damage. And in any case in which a person has so injured the Company's property, or defrauded the Company, the Company "may also enter upon the premises occupied by the offender and repair such injury, and do all such works, matters, and things as may be necessary for insuring the proper registering by such meter of the quantity of gas supplied by means thereof, and the expense of such repair, and of all works, matters, and things, shall be repaid to the Company by the person so offending, and may be recovered by the Company as gas-rates are recoverable." The existence of artificial means for compassing such evil deeds is to be *primâ facie* evidence of guilty intent. Gas supplies in bulk may be on a ten years' contract. The Order of 1872 is to be repealed. The Company desire to be able to apply for an Electric Lighting Order out of their funds.

The Institution of Mechanical Engineers have a Graduates' Association somewhat on the lines of the Students' Class of the Institution of Civil Engineers. Meetings are held on the second Monday in each month for the reading and discussion of papers, and arrangements are made for visits. At the meeting on the 9th prox., Professor R. T. Glazebrook, M.A., F.R.S., will lecture on the National Physical Laboratory and Engineers.

THE MOSELY LABOUR COMMISSION.

THE British Industrial Commission—more generally known as the Mosely Commission—has finished its tour in the United States; and the members are returning, or have returned, to this country. The Commission, it will be remembered, was composed of representatives of the workmen employed in the principal industries of Great Britain, and was formed, upon the initiative and at the expense of Mr. Alfred Mosely, for the purpose of enabling the working classes, through their delegates, to acquire a knowledge of the conditions under which the industries of the United States are carried on. For this purpose, the delegates were sent to America to make first-hand investigations, in the pursuit of which they were to have particular regard to: (1) The methods adopted for the early training of the working classes; (2) the relations subsisting between employers and employed; and (3) the general condition of the working classes, apart from the immediate circumstances of their employment.

Much interest in the visit of the Commission has been taken by our friends and competitors in the States, from the President downwards; and all possible facilities were afforded to the delegates for pursuing their enquiries. The question of prime interest to us is: Will this tour of workmen delegates remove, or tend to remove, any of the causes of trouble between capital and labour in this country? If the answer prove to be "Yes," then indeed will Mr. Mosely have conferred a lasting benefit on the nation. But, from the reports that have been telegraphed from time to time by the Special Correspondent sent out by "The Times" to accompany the Commission, we do not gather—nor, in truth, did we previously entertain—much hope that any lasting appreciable good will accrue. Some observers, in fact, have predicted that the chief result will be to introduce into America some of the economic heresies cherished by British Trade Unionists. That would truly be one of "life's little ironies."

Anyone who imagined that the Commission were going on a visit to an Utopian land where strikes are unknown and the voice of the Trade Union agitator is still—or where anything approaching such a blessed state of things really exists—would, it is hardly necessary to remark, have been suffering under a sad delusion. America has been no more immune from strikes than this country. Indeed, the labour struggles over there have been on a bigger scale, and of a more bitter and bloody character, than here; and anyone in doubt on the point should look up the statistics set out by Mr. Carroll D. Wright, the United States Commissioner of Labour, in the issue of the "North American Review" published last June. Strikes to the number of 22,793, causing a wage loss of $258,000,000, and the wasting of 145 million working days, in twenty years, is not a record supporting the idea that American employers are free from the harassment of labour difficulties.

No, it is not in freedom from strikes that the American manufacturer gets the pull over his British competitor. It is in the absence of an output-restricting policy on the part of the Unions that he finds his advantage. The American workman is not afraid to earn high wages; he has not swallowed the fallacy that the less he does and earns the more there will be for the "unemployed" to do and earn. So far at any rate as wages are concerned, he is Individualistic, not Socialistic, in his creed. And, further, the employer does not shrink from paying big wages to the man who will earn them. If a workman engaged on piecework discovers a method whereby he can double his output and his wages, the employer lets him take the higher wages; he does not cut down the rate to that man. The next labourer put to a similar job would be paid a lower piece-rate, but not the man who effected the improvement. In short, neither Unions nor employers have adopted the policies too often followed in this country, whereby individual enterprise on the part of the men is crushed or discouraged.

It is to be hoped that this difference between the methods prevalent in the old and the new countries has been fully appreciated by the Mosely Commissioners; but we are afraid that the delegates (representing as they do the Trade Unions who have so often openly disavowed the policy of restriction that they have secretly encouraged and pursued) will shrink from laying stress upon its importance in their reports. Some of them, in fact, sought to convince Mr. Carroll Wright, the Commissioner of Labour, that restriction of output by the workmen was not the policy of the British Trade Unions, when he declared that that policy and the backwardness of English employers to adapt themselves to new conditions were points in favour of American manufacturers. But Mr. Wright simply replied that the existence of that policy was established by facts and statistics collected by his department, and which he proposed to publish shortly.

The official report of the Commission will probably not be published for some little while, as the individual reports of the delegates (upon their visits to works engaged in the particular industries they represented) will need collation and digestion. But one definite outcome of the visit was announced while the Commission were still pursuing their inquiries, and that is the proposed formation of an organization in this country upon lines similar to those on which the National Civic Federation has been founded in the States. The delegates passed a unanimous resolution to the effect that, in the course of their investigations the excellent results achieved by that Federation had been

brought to their notice; the Federation having been successful, among other things, in bringing capital and labour into closer touch, "thus providing a practical solution for many of the difficulties and vexed questions that arise between the two."

One of the most important features of this Federation—which is of comparatively recent formation—is the section whose duty it is to get information of the first signs of impending trouble, and, in the earliest stages of a dispute, to step in for the purpose, not of judging upon the merits of the dispute, but of bringing the contending parties together, at a "round table," before an actual breach has occurred, and before either side has assumed a position from which it can recede only with difficulty. The Mosely Commissioners resolved that, in their opinion, "it would be of benefit both to workers and to employers were some similar organization brought into being in Great Britain." This proposed body is not intended to interfere with existing organizations, such as Trade Conciliation Boards, but is intended to afford "further means, not so much for the adjustment of troubles after they have arisen, as for their prevention."

We may say at once that we have no faith whatever in the supposed benefits that are to accrue from the establishment of any such Board of Interference. The great labour problem is not to be settled in this way. The American Civic Federation has been well described as "a self-constituted Witenagemote, a court without jurisdiction, and without a sheriff to enforce its judgments;" and, being called into existence, not by the parties concerned in any trade dispute, but by enthusiastic persons desirous of finding a pill to cure all labour troubles, yet possessing none of the practical and technical knowledge required for their consideration, it is extremely unlikely to result in practical good, while it is calculated, to the extent it raises hopes that cannot be fulfilled, to be productive eventually of much mischief. That is the opinion of the Chairman of one of the large railways in the States; and it is precisely the view we take of the Board which it is proposed to set up in this country.

Well-intentioned people—what a damning description that is!—seeing the suffering and loss occasioned by strikes on a large scale, imagine that all the trouble is due to "hot blood," and that if only some calm and collected body of men (having, be it noted, no previous acquaintance with the industry involved) could be allowed to interfere and talk persuasively to the parties who have allowed their tempers to overcome their reason, all would be well. And they argue, moreover, that, because the public usually suffers loss and inconvenience from a strike, the public have a prescriptive right to interfere. As regards the first point, the idea reflects more credit upon the imagination and good intentions than upon the knowledge and sense of those putting it forward. As regards the second, those who dwell so urgently upon the loss caused to the public by a strike, forget how much more ultimate loss may be occasioned them if the strike is—by reason of the pressure of public opinion—decided unjustly in favour of the men. If the London Gas Companies could be in such manner compelled to increase, without good cause, the wages of their employees to an extent equal to an addition of 1d. to the price of gas—instead of resisting the unjust demand, and thereby, perhaps, putting Londoners to some temporary inconvenience—the price that London would have to pay for averting a strike would be about £150,000 per annum. That is a point that many good people overlook. They cry for "peace" because of the cost of war—forgetting that peace has its disasters as well as war. "They prate of the blessings of Peace. We have made them a curse"—when peace has been bought at the price of putting an industry under the heel of a Union.

"The Times," which looks "with satisfaction" upon the proposed establishment of an institution resembling the American Civic Federation, remarks in a leader upon the subject that, "*if* British . . . workmen could but once master the elementary proposition that their own interests must, in the long run, be identical with those of their employers," the way would be opened for such an institution to do much good. But that is a very big "if"; and we would submit that "if" that condition is to be fulfilled before the proposed institution can come into play, such an institution stands condemned at once as being—and we believe it would be—absolutely of no value as an attempt to solve the labour problem of to-day. For the problem lies in the very "condition precedent" set out. When the workmen of this country have grasped the "elementary proposition," which, according to "The Times," they must grasp before a "civic federation" can step in with advantage, there will be no work for the Federation to do. The *crux* of the labour problem is the persuasion of the workman that his interests run parallel with his employer's. The solution lies, we believe, in profit sharing, combined with co-partnership; and the initiative towards that reform must be taken by the employers. Trade Unions hate it—it means their utter downfall as autocrats. "Civic federations" cannot bring it about. Salvation lies in the hands of the employers. That is why we have small hopes of substantial benefits from the itinerary of the Mosely Commission in America.

According to "Locomotion Automobile," the unpleasant noise made by steam or gas escaping from engines may be subdued by placing on the exhaust-pipe a cylinder in which works a piston provided with a spring or counterweight, the pressure of which confines the steam or gas until the force of the latter is great enough to overcome it.

USE OF GAS FOR WARMING ENCLOSED SPACES.

In the "Journal" for the 25th of November last (p. 1408), we published a reply by Mr. Thomas Fletcher to an article on the subject of heating enclosed spaces, contributed to the "American Gaslight Journal" by Dr. Birchmore, of New York, on the 27th of the previous month. The reply was reproduced in the pages of our contemporary on the 15th ult.; and in the last number to hand Dr. Birchmore deals with his critic's statements—not, he is careful to point out, as an answer to him personally, but to the article, the publication of which in the American "Journal" gave to it a value which he says he would not otherwise have attached to it. Dr. Birchmore declares that, intrinsically, the article disturbs him little; but this professed serenity is not strikingly apparent from the tone of his reply. But with this we have nothing to do.

Taking the points in the order in which they are dealt with, Dr. Birchmore first charges Mr. Fletcher with trying to make it appear that he was discussing the question of a room in which there were seven people, when he spoke only of three. He denies that he said anything about hospitals or a schoolroom for 180 children seven or eight years old. What he did say was that 50 cubic feet per hour per person was all that was required—that is to say, all that was absolutely necessary—in rooms used under the conditions sufficiently specified in his article; and he reiterates the statement as being quite correct. He explains, in regard to Mr. Fletcher's criticism of his use of the word "assumed," that he had taken 50 cubic feet "as a more convenient factor to deal with than the average minimum need—51·2874 cubic feet." If there was a statement that the 50 cubic feet were to be renewed once in twelve hours, it was a slip of the pen, which, however, he has failed to find on reading his article again. He maintains that everything—statement and context—shows that his reference was to renewal "per hour." Moreover, he says he nowhere assumed a renewal of 125 cubic feet in that space of time, as Mr. Fletcher made out, but always 150 cubic feet. Further, he declares that he distinctly referred to an apartment in a private house; and therefore he questions the relevancy of references to hospitals and schools. With regard to Mr. Fletcher's statement that "the loss of heat by walls and windows . . . has never been less than 75 per cent.," Dr. Birchmore points out that his critic does not say what the 75 per cent. refers to. He thinks that if Mr. Fletcher had had more experience as a scientific experimenter he would have separated walls and windows, and expressed himself thus: "When the walls are constructed with a suitable air space, as the best architects require, the radiation loss by way of the walls may be reduced to 0·08 calorie per square metre per hour; and with double windows the radiation loss by way of the window may be reduced to 0·03 calorie per square metre (say, yard) per hour per degree Centigrade of the difference in temperature between the air inside and outside." Mr. Fletcher stated that gas in the United Kingdom would vary to the extent of 30 per cent. in its heat units. Dr. Birchmore suggests that in England we are as behindhand in building as this variation in the heating power of gas would imply that we are in the manufacture of this commodity. As to flues, up which Mr. Fletcher admits 75 per cent. of the heat of his stoves is lost, he says he did not mention them; but he declares that if such loss occurred in America it would "keep a stove maker awake until he found some remedy." In conclusion, Dr. Birchmore says he considers he will not be wrong in characterizing Mr. Fletcher's article as "inaccurate in intention;" and he suggests as a reason for the attack upon him that his opponent is a maker of stoves with flues, whereas he published a statement of what could be done by a stove without flues, "with sufficient surface for heating the air, if the CO_2 of combustion were absorbed by damp Ca ($2OH$)." With this remark, Dr. Birchmore closes the subject, so far as he is concerned.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List see p. 44.)

The buoyant and cheerful feeling which possessed the Stock Exchange at Christmas lasted throughout to the close, and appeared again at the reopening after New Year's Day. Business, however, was not abundant, and a good deal of it was done inside, for the public are not yet fully attracted, though in all probability they will be coming in soon. Prices in every department pretty well made very nice advances; and the list was scarcely chequered by a retrograde movement. The Money Market, having got through the turn of the year without a rise in the Bank of England rate, was much relieved, and entered upon a phase of marked ease. The supply is now over abundant, and discount rates are much relaxed. In the Gas Market, business was only very moderate last week. But it participated in the general buoyancy, and prices were good; while some issues, that have lately been depressed for no particular reason, began to make recovery. In Gaslights, the ordinary was not very active, but it improved, opening at 85, and touching 86¼ on the closing day, with the gain of a point in the quotation. Of the secured issues, the debenture was the only one to show firmness; and the maximum dropped a point. South Metropolitan, which had been flat for some weeks, had a smart rebound, and jumped up

to 121—a price which it has not seen for a long time. In Commercials, nothing was done; and in view of their conversion, the quotations of the capital stocks were struck out. The Suburban and Provincial group were hardly noticed; and the Continental Companies were very quiet, but firm—Imperial gaining a point. Of the remoter undertakings, Buenos Ayres, River Plate, and Melbourne advanced. Business in Water was limited; but some issues made advances of from one to five points.

The daily movements were: On Monday, South Metropolitan rose 1, and River Plate ¼. On Tuesday, South Metropolitan, Imperial, and Melbourne 4½ per cents. gained 1 each. In Water, East London 3 per cent. debenture improved 1. On Wednesday, South Metropolitan rose 1, and Buenos Ayres ¼. In Water, Grand Junction and Southwark moved up 2 each, and ditto "D" 5. On Friday, Tuscan and Gaslight ordinary rose 1 each; but ditto maximum fell 1. On Saturday, Kent Water rose 5.

We append as usual a comparative table showing the prices of Gas and Water Stocks on the last day of the year, and the corresponding prices of a year ago. The reductions in Gas Stocks are to be accounted for by the extraordinary quietude and heaviness of the market ever since the autumn, which has depressed prices regardless of the internal prosperity of the undertakings. The year has been by no means a bad one for Gas, and the prospects of 1903 are quite as bright. The advance in Water securities is the result of the passing of the Government Bill.

GAS COMPANIES.	Prices on Dec. 31, 1901.	Prices on Dec. 31, 1902.	Gain or Loss.
Alliance and Dublin Company, 10 per cent.	18—19	18—19	—
Do. 7 per cent.	13—14	12¾—13¾	−¼
Australian (Sydney) 5 per cent. Debentures	100—102	—	—
Bombay, Limited	6¼—6⅝	5⅞—6	−⅜
Do. New, £4 paid	4¼—4⅝	4—4¼	−¼
Brentford, Consolidated	263—270	247—252	−18
Do. New	192—197	181—185	−11½
Do. 5 per cent. Preference	130—135	134—139	+4
Do. 4 per cent. Debenture Stock	112—115	110—113	−2
Brighton and Hove, Original	213—218	207—212	−6
Do. A Ordinary Stock.	150—155	152—157	+2
British	41—42	39½—40½	−1½
Bromley, Ordinary 10 per cent.	24—26	22—24	−2
Do. 7 per cent.	19—21	18—20	−1
Buenos Ayres (New), Limited	9¼—9⅝	10¼—10⅝	+1
Do. 4 per cent. Debenture	94—97	92—94	−2½
Cagliari, Limited	22—24	23—25	+1
Cape Town and District, Limited	14½—15½	14¾—1⁵⁄₁₆	—
Do. 6 per cent. 1st Mort.	52—54	53—55	+1
Commercial, Old Stock	265—270	250—260	−12½
Do. New do.	203—208	200—205	−3
Do. 4½ per cent. Debenture Stock	130—135	130—134	−½
Continental Union, Limited	162—167	133—138	−29
Do. 7 per cent. Preference.	160—165	140—145	−20
Crystal Palace Ordinary 5 per cent. Stock.	122—127	117—122	−5
Do. 5 per cent. Preference	123—128	120—125	−3
European, Limited	19—20	18—19	−1
Do. £7 10s. paid	14—15	13—14	−1
Gaslight and Coke, 4 per cent. Ordinary	97—99	84—86	−13
Do. 3½ per cent. maximum	88—90	86—84	−2
Do. 4 per cent. Con. Pref.	111—114	110—112	−1½
Do. 3 per cent. Con. Deb.	90—92	91—93	+1
Hong Kong and China, Limited	13—14	14½—15½	+1½
Imperial Continental	208—213	202—205	−7
Do. 3½ per cent. Deb. Red.	100—102	99—101	−1
Liverpool United A	232—234	224—226	−8
Do. B	170—173	165—167	−6
Do. Deb. Stock	110—120	114—116	−4½
Malta and Mediterranean, Limited	4⅜—5	4—4½	−½
Metropolitan of Melbourne, 5 p. c. Deb.	105—109	104—108	−1
Do. Do. 4½ p. c. Deb.	102—104	103—105	+1
Monte Video, Limited	9—10	9—10	—
Newcastle and Gateshead, Consolidated	214—216	102—105*	−8
Do. 3½ p. c. Deb. Stk.	98—100	97—100	+½
Oriental, Limited	7½—8	—	—
Do. New, £4 10s. paid	6¾—7⅛	140—145*	—
Do. do. 1879, £1 paid	1⅛—1⅜	—	—
Ottoman, Limited	5⅝—6⅛	6⅛—7	+⅜
River Plate, Ordinary	9⅜—10⅛	10⅛—10⅜	+⅛
Do. 4 per cent. Deb. Stock.	94—97	92—94	−2½
San Paulo, Limited	11—12	11½—12½	+½
Sheffield, A.	242—244	236—238	−6
Do. B.	241—243	235—237	−6
Do. C.	241—243	233—235	−8
South Metropolitan, 4 per cent., Ordinary	123—125	119—122	−3½
Do. 3 per cent., Deb. Stk.	92—94	92—94	—
Southampton, Ordinary	102—106	103—107	+1
Do. 4 per cent. Debentures	104—109	102—105	−3
Tottenham and Edmonton, A 5 per cent.	122—127	118—123	−4
Do. B 3½ per cent.	95—100	93—96	−3
Tuscan, Limited	7⅞—8½	7⅞—8½	—
Do. 5 per cent. Deb. Red.	95—100	96—98	−½
West Ham, 10 per cent.	9¾—10½	10—11	+½
Do. 7 per cent.	12½—13½	13¾—14½	+1

* Converted Stock.

WATER COMPANIES.	Prices on Dec. 31, 1901.	Prices on Dec 31, 1902.	Gain or Loss.
Chelsea, Ordinary	310—320	310—320	—
Do. 5 per cent. Preference	150—155	150—155	—
Do. 4½ per cent. Preference Stock, 1875	138—143	138—143	—
Do. 4½ per cent. Debenture Stock	140—145	140—145	—
East London, Ordinary	200—205	225—235	+27½
Do. 4½ per cent. Deb. Stock	140—145	142—147	+2
Do. 3 per cent. Deb. Stock	95—100	97—99	+½
Grand Junction 10 per cent. maximum	113—116	115—120	+3
Do. 4 per cent. Deb. Stock.	122—126	125—130	+3½
Kent	300—305	300—310	+2½
Do. New, 7 per cent. maximum	200—205	200—210	+2½
Lambeth, 10 per cent. maximum	293—298	305—315	+14½
Do. 7½ per cent. maximum	217—222	220—230	+5½
Do. 4 per cent. Debenture Stock.	125—130	125—130	—
New River, New Shares	395—405	395—405	—
Do. 4 per cent. Debenture Stock.	125—130	125—130	—
Southwark and Vauxhall, Ordinary	193—198	207—212	+14
Do. Do. 7½ per cent. max.	183—188	200—210	+19½
Do. Do. 5 per cent. Pref.	150—155	151—154	—
Do. Do. 4 p. c. A Deb. Stk.	124—129	125—130	+1
West Middlesex	280—290	295—305	+15
Do. 4½ per cent. Deb. Stock	137—142	140—145	+3
Do. 3 per cent. Deb. Stock	96—98	97—99	+1

PERSONAL.

Mr. S. Bertram Chandley, of Warrington, has accepted the position of Engineer and Manager to the St. Mary Cray Gas Company, in preference to the appointment at Tyldesley, for which he was the selected candidate.

Mr. R. H. Ginman, of Atherton, has been appointed Manager of the gas and water works of the Tyldesley Urban District Council, in succession to Mr. W. H. S. Gendall, whose resignation was announced a few weeks ago.

Many engineers who have been brought into business and friendly contact with Mr. Archibald Little, of Smethwick, will regret to learn that he has been alarmingly ill. Happily, however, the crisis has passed; but his medical attendant states that his patient will be unable to leave his bed for at least another fortnight. That he may have a speedy recovery will be the earnest wish of his large circle of friends.

Mr. T. J. Richardson, who has for many years served the Norwich Corporation in the capacity of Auditor of the accounts of the British Gaslight Company, has tendered his resignation. This was accepted at the last meeting of the Town Council; and on the motion of the Mayor, a vote of thanks was accorded to Mr. Richardson. The question of filling up the vacancy was referred to the Executive Committee for consideration and report.

The son of Mr. R. A. Browning, Assoc.M.Inst.C.E., Engineer and Secretary of the Neath Corporation Gas Department, who recently came of age, has been the recipient of a handsome smokers' cabinet, subscribed for by the employees at the town gas-works. To mark the kindness and goodwill of the men, and to commemorate the event, Mr. Browning invited the workmen to dinner at the Castle Hotel. Mr. Browning presided, and his cheery manner greatly enhanced the pleasures of the evening. The toast of the evening, "Mr. R. A. Browning and family," was enthusiastically received; and the after-dinner speeches showed the excellent feeling subsisting between employer and employed at the Neath Gas-Works.

On Christmas Eve, the officers and workmen at the East Greenwich station of the South Metropolitan Gas Company met in the men's dining-room for the purpose of presenting Mr. P. S. Morton, who is leaving for Coventry, with golf and smoking sundries, in remembrance of his three years' association with them. The presentation was made by Alderman Tysoe, the Engineer of the station, who wished Mr. Morton every success in his new sphere of work. Mr. Morton thanked Alderman Tysoe and all connected with the East Greenwich works for the kind treatment he had invariably received from them, and for the handsome presents with which they were sending him off. The presents consisted of a set of golf clubs and bag, a silver-mounted cigar-case, a case of pipes, and a silver cigar-box; the latter bearing the following inscription: "Presented to P. S. Morton, by the officers and workmen of the East Greenwich Station of the South Metropolitan Gas Company, on his leaving for Coventry, Christmas, 1902." An expression of good-will towards Alderman Tysoe, with best wishes for the New Year, by the employees at the station, and a similar expression from him to them, accompanied by an acknowledgment of his gratification at knowing that all at East Greenwich worked well and harmoniously in the Company's interests, closed a pleasant interlude in the morning's work. We may mention that Mr. Morton is the son of Mr. Robert Morton, one of the Directors of the Company, and he is going to assist Mr. Fletcher W. Stevenson at the new gas-works which are being erected at Foleshill for the Coventry Corporation.

The Late Mr. Mark Knowles.—The recent death is announced, at the age of 69, of Mr. Mark Knowles, the well-known temperance advocate. Deceased was an inventor, and for some time carried on business at Blackburn. Having been approached with the view to his becoming a political candidate at a general election at Blackburn, he declared that if he entered Parliament it would be as a member of the English Bar. With this object in view, at the age of 41, he commenced studying for the law; and he succeeded in qualifying in 1879. His first case was a retainer on behalf of the South Metropolitan Gas Company; and the Company were successful.

An Attack on Municipal Trading.—A few weeks ago, a conference of the United Property Owners' and Ratepayers' Association of Great Britain was held in London, at which a paper was read by the Hon. Vicary Gibbs, M.P., a member of the Council of the Industrial Freedom League, on "Municipal Trading." He showed, as we have often pointed out, that the system tends to discourage private enterprise, increase local indebtedness, and impose burdens upon the present generation of ratepayers. He contended that the duty of a local authority is to supervise and control, and not to enter into competition with private enterprise until this has been proved to be incapable of doing what is necessary; and he concluded by making a strong appeal to the ratepayers to bestir themselves in this matter. The paper has been reprinted in pamphlet form, and is issued by the League from their offices, 53, Parliament Street, S.W.

THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

DESCRIPTION PREPARED

BY

WALTER RALPH HERRING, M.INST.C.E., *Engineer.* *

ARTICLE I., accompanied by two Plates—Plate 1 being the Plan of the Site, showing the method of surveying same, and giving several transverse sections and longitudinal sections; and Plate 2, a Block Plan of the Works, with which has been amalgamated the Key-Plan of the Drainage Scheme.

The story of the inception of the Granton Gas-Works, and the facts and circumstances which induced the Edinburgh and Leith Corporations' Gas Commissioners to launch such a bold scheme of gas-works construction, have already at different times appeared in the columns of the "JOURNAL;" and, while it may on some future occasion be written in more deliberate sequence, for the present it is sufficient to remind readers of the existence of the works now in full operation.

The site of the works is on the southern shores of the Firth of Forth, about five miles due east of the Forth Bridge and three-quarters of a mile west of Granton Harbour, with which the works are connected by a private railway; the line also giving access to the North British Railway system. The Caledonian Railway crosses the south-east corner of the site, at which point a connecting branch has been laid so as to give access to the works both for passenger and goods traffic. By these means, sea-borne traffic is brought into direct opposition with the two Railway Companies; the Commissioners having private rights of running their own traffic to and from the harbour—the lines being the property of the owner of the harbour, the Duke of Buccleuch.

These traffic facilities were the primary circumstance which induced the selection of the Granton site. The advantages of its configuration were not, however, neglected, nor was the fact that the substratum, so far as it could at the time be investigated, was of such a character as to afford good foundations at reasonable depth, and particularly an excellent base for the construction of gasholder tanks.

The area of the site is 106¼ acres, together with the right of recovery to 4½ acres of foreshore. A lump sum of £124,000 was paid for the site, which sum included important concessions in the way of rights for the tipping of refuse on the foreshore, a foreshore reclamation scheme, the conversion of a disused quarry on the foreshore into a private harbour having an area of 4·8 acres, the construction of a deep-water jetty, the laying of about half-a-mile of railway through private land to the Commissioners' eastern boundary, as well as minor rights, such as the use of water from a stream flowing through the site. It was also known at the time that there was a large bed of stone beneath certain portions of the land; and this has subsequently been opened up and used in the construction of the works. The average price of the actual land acquired worked out at £1167 per acre.

The site of the works is about four miles from the General Post Office in Edinburgh, but only 2¾ miles from the existing central gas-distributing station, where most of the holders at present stand; the new works and this station being coupled up by means of a 48-inch cast-iron main, which, it may be mentioned, has been laid to work up to a maximum pressure of 5 lbs. on the square inch. Thus, at no future time will it be necessary to lay an additional trunk-main to the distributing station, as additional quantities of gas are required. The pumping appliances that have been put down will simply propel a larger volume at the increased pressure.

The configuration of the site, together with its location in regard to the Firth of Forth, and the adjoining railway systems, will be appreciated by reference to Plate No. 1. The main site, which is specially reserved for gas-works purposes, occupies an area of 88·83 acres, the levels of which varied from between 60 to 90 feet above Ordnance datum. The products works site, to the north of the main plot, extends down to the sea-shore; the variations in the level being more acute.

Upon first acquiring the land (in November, 1898), the whole area was surveyed, in order to have in the office in Edinburgh an exact record of the varying levels of the ground, and so facilitate the plotting of the works in the office, and determine the general disposition of the respective parts—particularly with relation to the entire occupation of the site in the distant future. The Caledonian Railway crossing the south-east corner of the site, and the private line communicating with the harbour and the North British Railway system approaching in a north-easterly direction (both converging to the eastern boundary of the works), determined the general position of the works to a considerable extent; and the block plan—Plate No. 2—will show in what way this ultimately resolved itself.

Plate No. 1 is given as an example of how to deal with the site of a works some distance removed from the office, so far as its survey is concerned, in order to have all figures and data to hand in the plotting of the same. In this particular case, there was no occasion to determine an artificial datum-line. The northern boundary of the main site was a perfectly straight line; and the eastern boundary was struck at right angles to it, through the middle of a field, in order to afford a connection with the Caledonian Railway at the south-east corner of the site. Having these two base-lines to work upon, the area was divided from north to south into lines spaced 50 feet apart, forming longitudinal section lines, and from east to west, 200 feet apart, forming transverse section lines. There were also a certain number of intermediate section lines taken where variations in the levels were acute, and were otherwise important—such as the centre lines of projected buildings, &c. These, however, are not shown, as they are of no general interest. The 50-feet spaced longitudinal lines have also been omitted on the plan, but are indicated upon the transverse sections of the ground, figures 3, 4, 10, and 14 of Plate No. 1.

These sections are merely stated to show in what way the site was dealt with, in order that a record of every variation of level might be in the office, and at present may be taken as an example of a good method of commencing the plotting of a site. The section lines can, of course, be determined at any distance apart; but the distances given for the very large area dealt with were considered sufficient for the scale upon which operations were to be carried out, excepting upon the products works site, adjoining the deep-sea harbour, where they were more frequently taken, owing to the increasing declivity of the ground in the direction of the sea.

The figures on the intersecting lines represent the levels of the ground surface in feet. at that particular point, above Ordnance Datum line. The variations in the levels can be better seen by reference to the cross section of the transverse section lines No. 14. This illustrates the natural lie of the ground from the sea-level or Ordnance Datum; the various levels being indicated in figures on the respective lines, at distances 50 feet apart from north to south.

The cross section of the transverse section No. 10 illustrates the change of level through the old disused quarry, and which also passes directly through the centre of the products works, and the deep sea harbour; the hatched lines on the section representing the altered levels on which the products works now exist.

The sections of transverse section lines No. 3 and No. 4—to the right hand of Plate No. 1—show the original levels of the ground; the hatched line representing the present levels. These two section lines practically run through the portion of the works now existing.

The section of the longitudinal section line No. 3 at the bottom of the drawing, illustrates, by means of a hatched line, the new general level of the ground. It will be seen that in constructing the first section of the works, it has been necessary to overcome the natural variations of the site on the eastern end, by filling in surplus excavation from elsewhere; but that at about the transverse section line No. 7 a practically uniform lie of the ground is met with—rising 1 in 130 westward (this being the determined slope from east to west for the completed area). From south to north the general lie of the ground is to be as shown by the transverse section lines No. 3 and No. 4; the various blocks of buildings rising 1 in 130 from east to west the full extent of the site.

Plate No. 2 gives a block plan of the works so far as they at present exist, together with the future sections in dotted lines. To the eastern boundary, the private railway from Granton Harbour—communicating also with the North British Railway and the double line branch from the Caledonian Railway—are seen to converge for the purpose of distributing the traffic upon the works sidings; and the general arrangement of the railways upon the works shows by what means the traffic can be afterwards handled and delivered to the respective sections. A railway station and platform for the workmen's trains are also on the eastern boundary, communicating by means of a footbridge and staircase across the railway sidings with the general yard level about 80·6 feet above Ordnance Datum.

The lines of communication for the import and export of the traffic are, of necessity, the guiding feature in dealing with a works of this character; and it may perhaps be easier to explain the general plan of the works by here stating the theory of its conception.

In the first place, it was desired to make the works as presentable as such works can be made to the public eye without sacrificing anything to the efficiency of the place as a manufacturing concern. The main road from Edinburgh approaches the works on the southern side, and is on a higher level than the latter. Consequently, the public will at all times obtain a pretty extensive

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PHOTOGRAPH No. 1.—Illustrates the diversion necessary to conduct the culvert transversely under the floor of No. 1 retort-house. The manhole on which the bricklayers are seen to be working is now exactly central in the length and breadth of the retort-house. The photograph also shows the levelling-up process with the surplus excavations being removed from elsewhere.

bird's-eye view of the works. The general lie of the ground along the north boundary wall afforded the best and most economical site for the construction of the gasholder tanks. The purifiers —being a part of the works where naked lights are undesirable, and from which unpleasant smells occasionally arise—have been placed immediately to the south of the gasholder. Intervening between the line of purifiers and the manufacturing section, is a coke yard.

It having been determined that inclined retorts should be the system of carbonizing at these works, for such a plant it is most convenient to receive the coal at one point only—irrespective of the fact that it was necessary to deal with 1000 tons of coal in an ordinary day of ten hours. The coke also is to be handled mechanically after falling from the retorts. Its transportation, therefore, in a northerly direction away from the main entrance and the main road was an easy matter to accomplish.

The disposition of the retort-house and coal-store buildings was, therefore, arranged as shown on Plate No. 2. The incoming coal traffic is marshalled upon the sidings adjoining the eastern boundary of the works. The loaded coal waggons are drawn from there and passed on to the sidings between the retort-house and the coal-store.

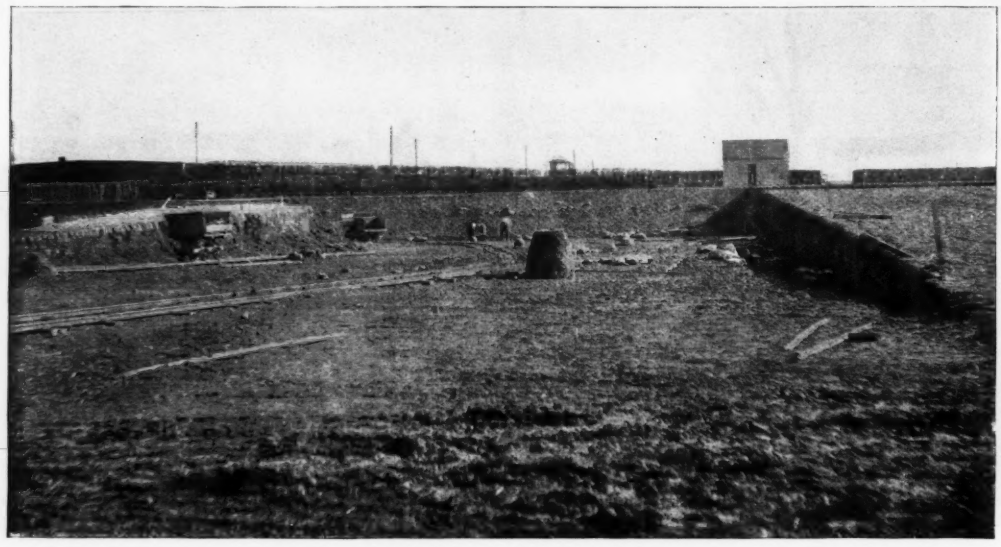
At the centre of the retort-house the waggons are discharged of their coal, and passed forward in a northerly direction, where the empties are brought into position for loading with coke and refuse; both of the railways between the retort-house and the coal-store being feeding lines for the retort-house. Seeing that (apart from the time when coke is being put in stock) the same bulk of material has to be dispatched from the works as is received in the form of coal, there is of necessity a constant supply of empty waggons at the coke-handling plant.

It was also determined to place the boilers at the north end of the buildings, and to convey the steam to the engines at the south end, rather than have the expense, and the accompanying dirt and unsightliness, of transporting the fuel to the boilers and the ashes away therefrom. The filling of the coal-store is also done mechanically from the north end, so that by this means the whole of the dirty work associated with a gas-works is concentrated at one point of the works, and the principal part of the works themselves can be kept clean and tidy, and inoffensive to the most æsthetic eye.

The complete area of the site is set out for seven sections. It was originally intended that these should be 5 million sections. In plotting the site, however, it was found that considerably larger sections could be accommodated on practically the same area of ground, with the result that what were originally intended to be 5 million are now 10 million sections; so that the area of 88·83 acres will ultimately accommodate plant for the production of 70 million cubic feet of gas per day, which works out at an average of 1·26 acres per million cubic feet of daily manufacture at the time of heaviest consumption.

The products works are situated upon the lower level of the site, in close proximity to the deep sea or Commissioners' private harbour. The works also have railway communications to Granton Harbour, as well as to the North British and the Caledonian railway systems. The area set apart for this purpose is

PHOTOGRAPH No. 2.—Shows the track to make a connection with the Caledonian Railway at the south-east corner of the site. The débris lying upon the right-hand side of the sidings within the works, it may be interesting to remark, is the material removed from the celebrated tall chimney at the New Street Gas-Works; the whole of the material from that structure having been used in the construction of foundations at the Granton Works.



PHOTOGRAPH No. 3.—Is a view looking to what is now the main entrance to the works. It illustrates the levelling of the site for the retort-house and exhauster house.

86·7 acres. There is room on this area for the construction of additional ammonia products works as well as tar-works and other subsidiary processes.

The portion indicated to be reclaimed from the sea is, properly speaking, a projected tip for refuse. Upwards of half-a-million cubic yards of refuse material can be conveniently disposed of, by constructing a sea-wall on the lines indicated.

The south frontage of the site, along the West Granton Road—an area of 8·79 acres—is to be occupied eventually by a suite of offices, and, if found necessary, by workmen's houses.

It is perhaps important to remark that the disused quarry shown upon the site is at present utilized as a water reservoir, but will ultimately be filled in when this part of the ground is required for manufacturing plant.

The quarrying operations carried on by the Commissioners since they took possession of the area are shown also on the plan to the south of Granton House. It may be noted that no quarrying has been done within the line of the projected buildings of the future on this plot.

Drainage Scheme.

The satisfactory drainage of a gas-works site is important in all cases—much more so when the site is extensive and happens to be at the base of a natural watershed of large area, discharging into the estuary of a tidal river. Such was the case with the Granton site; and while the author wishes to distinctly point out that it was not a water-logged site, there was every prospect of having very considerable trouble with surface water, draining forward from neighbouring lands across the site to the shores of the Firth of Forth.

The excavations necessary for the construction of railways, foundations, pipe-lines, &c., of necessity, cut through in a hopeless degree the agricultural drains, of which a very large number crossed the site; and at the very outset, to have carried on the constructional operations with success, it was necessary to provide for the disposal of this water. A permanent drainage scheme was therefore devised. After the plotting of the works and the general disposition of the respective plant and appliances had been determined, the details had to be sufficiently advanced in order to determine the deepest levels to which the foundations were to go, as well as any permanent variations in the level—such as for machinery pits, subways, purifying plant, valves and connections, &c.

This accomplished, the next question was to determine the best line upon which the main drains should be laid, in order to serve, as far as possible, the largest area of ground, and to be convenient for the drainage of future sections. At this stage, however, it is important to remark that a burn crossed the site in a north-easterly direction, passing through neighbouring lands, and discharging at high-water mark in the Firth of Forth.

The Commissioners, in their bargain, secured powers to divert this stream in any direction they thought fit, and to form it into a culvert not less than 12 superficial feet in area. They also, at the same time, came under an obligation not to discharge offensive effluents into this particular stream, without at the same time continuing its formation as a culvert through the neighbouring lands, and discharging on the shores of the Firth of Forth below low-water mark.

There were, therefore, two alternatives to consider; and, after very carefully weighing up the costs of both schemes, it was discovered to be more economical, and more suitable as to levels, to lay a complete drainage scheme of their own, discharging below low-water mark in the Firth of Forth, than to undertake the conversion of the stream into a culvert to low-water mark. The distance in the latter case was greater, and the position of the stream crossing the works was such as to have prevented the drainage of the northern half of the site satisfactorily. Under the circumstances, therefore, the scheme about to be described was determined upon; and Plate No. 2 indicates (in heavy dotted lines) in what manner the pipe-lines were ultimately laid.

Commencing at low-water mark in the Firth of Forth, and to a point marked "A" on the plan, a line of 24-inch cast-iron pipes were laid. The construction of the supports for these pipes was a tidal operation; the work having to be carried out between tides. The method of supporting the pipes consisted of the construction of concrete piers sunk to the rock beneath the sandy beach, or a distance of 18 inches into the boulder clay, where rock was not found. In some cases from 6 to 7 feet of sand had to be passed through; and the method of constructing these was to form a caisson, inside of which the men worked, and which was made to sink as the excavation of the sand was accomplished. When at the bottom, in the event of rock being found, it was drilled in several places, and steel pins inserted, run with neat cement grout; the entire caisson being then filled with concrete, and brought to the necessary level above the foreshore for the line of pipes. One of these supports was provided in the centre of each 12 feet length of pipe. Foundation bolts were imbedded in the concrete on either side; and when the pipes were laid in position, a 4 inch by $\frac{3}{4}$ inch flat strap, half hooped, encircled the upper half of the pipe, and was secured to the foundation bolts on either side. For the greater part of the distance, the pipe rises above the surface of the shore level; and notwithstanding the fact that there have been some very severe storms since it was placed in position, it has stood the test, and remained intact, without a sign of giving way.

From the point "A" on the shore, as shown on the plan, to a point "E" near the existing gasholder, a 24-inch earthenware drain-pipe line was laid; a branch being left for the products works and also, at "C," for continuing in a westerly direction. Junctions were turned in a southerly direction for coupling to future sections of the works.

From a point "E," with the depth varying between 5 and 6 feet to 22 and 23 inches below the natural surface, the drain takes a turn in a due southerly direction—passing up between the existing and the future gasholder, and under the lowest level of the existing and what is to be the next adjoining purifying-house; the levels being sufficient to drain the lowest level of the excavations which were necessary for the foundations. This affords a permanent source of drainage for all waters emanating from the purifiers and the purifying-house.

Immediately at the southern corner of the purifying-house, the drain is turned in a south-easterly direction to a point opposite the corner of No. 1 retort-house, along the line of which, and 20 feet out, it is laid. The depth of this section approximates 23 feet.

The level of the drain at the centre of the retort-house is 20 feet below the present retort-house clinkering floor-level; this being the greatest depth required for the coal breaking and elevator pits—the drain passing beneath the bottom of these. From this point, the drain rises somewhat more rapidly to the extreme south end of the exhauster-house—the gradient being 1 in 32·5—and thereafter to the boundary on the West Granton Road. Some portion of this work was carried out by open

PHOTOGRAPH No. 4.—Illustrates the main drain track on the western side of the retort-house. The present level of the railways is shown by the waggon on the left-hand side. The foundations for the retort-house walls are on the right-hand side; the level of the concrete there shown being 2 feet below the present floor-level

trenching, and the deeper levels by driving headings from manhole to manhole.

The products works site lying upon the lower levels of the main site, the main drain was made to pass in close proximity to the projected products works, in order to receive the effluents from them. Opportunity was taken when the drain track was open to lay cast-iron pipes for conducting tar and liquor from the main works by gravitation to the storage tanks upon the products works site. A 9-inch and a 6-inch pipe were provided in this track, as well as a 4-inch water-pipe. The tar and liquor are separated upon the upper site of the works; the tar being made to flow through the 6-inch pipe to the storage tanks on the products works site. The 9-inch pipe is intended to convey ammoniacal liquor to the adjoining tanks on the site. The effluents flow by gravity from the gas-works to the products works.

Throughout the length of the main drain, at convenient intervals, the circular type of manhole was constructed to give easy access to the drain. Branch pipes were also laid at all places where permanent drainage was needed, as well as at all places where temporary facilities for getting rid of water from excavations, &c., were likely to be required.

The main-drain laying operations were among the first commenced—a few months only after obtaining possession of the site, and were in due course completed, by contract, for the lump sum of £1744 11s. 6d. In all, there are 116 yards of cast-iron 24-inch main, and 600 yards of 24-inch fire-clay pipe-drain, with eight manholes, and 600 yards of 18-inch fire-clay pipe-drain, with ten manholes, together with numerous branches.

The portion of the work on the foreshore, consisting of the cast-iron mains, cost £254 6s. 1d., including the labour in laying them, and £91 1s. 2d. for the construction of the supporting concrete piers. The latter work was done by the Commissioners' own employees; and these costs are over and above the lump sum already given.

The very great advantages of having a complete drainage scheme in existence before the work of construction was commenced upon the site is worthy of particular notice; and without exaggeration it may be said that the total cost of the scheme has already been recovered, in consequence of the ease with which the deep excavations and foundation constructions have since been carried out, and the total absence of inconvenience from water—either surface or from springs.

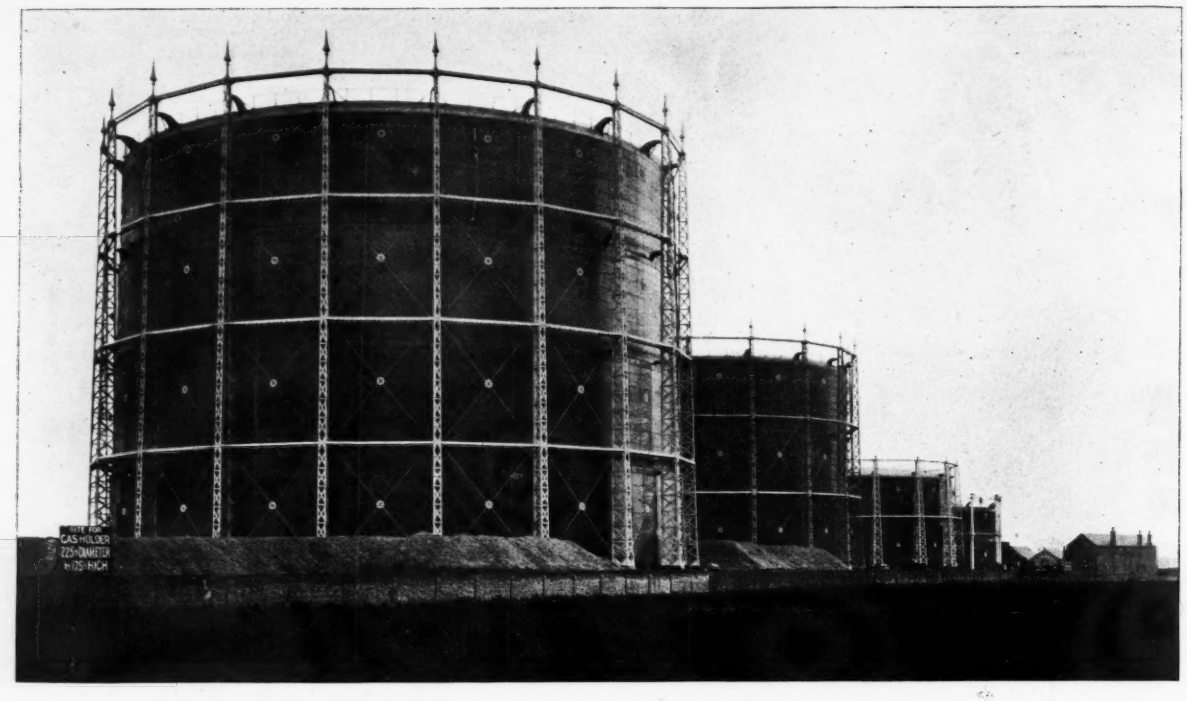
Before commencing any excavation, the first thing done was to lay a drain from the nearest connection on the main drainage scheme to the nearest and deepest point where the excavations were to begin. In this way, notwithstanding the fact that the foundation work was carried out during a year of excessively wet weather, no trouble whatever was experienced in sinking to the greatest depths necessary. The economy in labour by keeping the excavations dry—enabling the men to work better, as well as necessitating less elaborate methods of timbering, owing to the ground being well drained—has been of supreme advantage throughout the carrying out of the work; and as the Commissioners have done practically the whole of the excavating and concreting work by their own men, the advantages have been directly acquired.

The stream shown on Plates Nos. 1 and 2, and which has been previously mentioned, required to be diverted at several points, and converted into a culvert for the whole length passing through the Commissioners' lands. This was constructed in area equal to 11 square feet, so as to afford room for the heavy flow in rainy seasons. At the same time, a 6-inch water-pipe was suspended from the roof, to convey water from the harbour reservoirs for the convenience of the harbour authorities.

PROGRESS OF GAS CONSUMPTION IN A LONDON SUBURBAN DISTRICT.

THE picture on p. 28 is from a photograph specially taken of the string of gasholders actually being worked by the Tottenham and Edmonton Gas Company; and its significance lies in the circumstance that it exhibits at a glance the growth, in geometrical ratio, of that demand for gas which is at once the characteristic of the populous regions surrounding the Metropolis, and the despair of the speculator in electric lighting. Much more eloquent than any words or figures could be is this grand line of gasholders, which speak to the eye of the most careless passer-by on the adjacent railway line, and also appeal to the local resident and householder with their witness to the incessant efforts of the Gas Company to supply customers with the most popular source of light, heat, and power. Fortunately for the Company, they were able to secure at the right time a long strip of land of a character eminently suitable for the construction of gasholder tanks, and widening so as to invite the increased diameter of these structures which was otherwise suggested. And, of course, as the size of the tanks was increased so the height of the gasholders rose in proportion to their diameter. The peculiarity of the site as regards the pictorial effect is in its presenting a view of all the holders together, not omitting the placard which indicates for the behoof of all whom it may concern the intention of the Company to build yet another holder in continuation of the existing line, of proportionately larger dimensions.

The telescopic holder on the extreme right was in use in 1875, when the undertaking entered upon its present phase of development at this site, and is 100 feet in diameter and 48 feet high, with a capacity of 360,000 cubic feet. It has a framing of cast-iron columns, with the usual double tier of horizontal lattice girders, and diagonal tie rods. The next in the series exhibits the influence of fresh ideas on the subject of guide-framing; this being of wrought-iron. The holder was built in 1882 by the Horseley Iron Company. It is 130 feet diameter, 62 ft. 6 in. working depth, with a capacity of 750,000 cubic feet. It was followed in 1893 by a three-lift holder of 150 feet diameter, 93 feet high; holding 1,600,000 cubic feet. The latest, built in 1902, measures 180 ft. diameter, and rises in four lifts to 127 ft. 6 in. high; having a storage capacity of 3,100,000 cubic feet. The whole series therefore constitute a striking progression; and the end is not yet in view. With the single exception mentioned, all the holders are of Messrs. Cutler's building; and the tanks (brick and puddled) are by Messrs. John Aird and Son. The workmanlike and neat guide-framing, which has become standardized as shown, is the design of Mr. E. A. Broadberry, the Engineer of the Gas Company. It leaves nothing to be desired upon the score either of suitability or appearance, whether the holders are full or empty. The photograph was taken by desire of Mr. Corbet Woodall,



Storage Holders Constructed between 1875 and 1902 for the Tottenham and Edmonton Gas Company.

the Chairman of the Company, who was the first to be struck with the value of the object-lesson in the growth of the suburban gas industry furnished by this remarkable series of gasholders; and we are glad to have the opportunity, through his kindness, of beginning the New Year with so comforting a presentment of the truth that the expansion of the gas industry is not yet within sight of its climax. A geometrical progression of the dimensions of the gasholders even of the Tottenham and Edmonton Company cannot, one may suppose, go on indefinitely, or the whole country would not be big enough to accommodate them.

COMMUNICATED ARTICLE.

TESTING OF LOW-QUALITY GAS.

By John T. Sheard, F.C.S.

Of the many interesting topics dealt with by Professor Lewes, in the series of lectures he recently delivered before the Society of Arts, one of the most important to gas companies is that of the right method to be followed in testing the future gas supply. If, as there seems no reason to doubt, the economic interests, alike of the consumer and supplier of gas, demand that in the immediate future a lower quality shall be supplied than now generally obtains—necessitating a revision of the method of testing—it is imperative that an agreement should be come to as to how such testing should be carried out, so as to be fair to both the supplier and consumer of the gas. The question of how, or from what materials, the future gas can be most economically produced, may be safely left to work itself out, in the best possible way, by natural development. But obviously the conditions of testing must be settled beforehand, so as to provide a guide and criterion for the operations of the gas manufacturer. In any such settlement, Professor Lewes's opinion will properly have great weight and influence; and it is because I am convinced, and hope in this article to prove, that the method he has outlined and suggested will, if adopted, be very prejudicial to the interests of suppliers of gas, that I offer the following remarks on the subject.

If the present standard burner—the No. 1 "London" argand—is to be retained, Professor Lewes shows that it must be used in a different way to what it is at present. He mentions four different conditions that might be prescribed for its employment. The method he prefers is to burn sufficient gas to yield a 16-candle flame, and calculate, from the observed consumption, what is the equivalent candle power for 5 cubic feet. But he asserts that a 16-candle flame and a 3-inch flame are, for all practical purposes, identical; so that the proposed method comes to mean neither more nor less than the imposition of an equivalent to Sugg's illuminating power meter, which, it will be remembered, was based on the assumption that the illuminating power of gas varied inversely with the quantity required to yield a 3-inch flame in the No. 1 "London" argand. The proposition only needs stating in such plain terms to be immediately rejected; for while the illuminating power meter may be a good "indicator of *constancy of quality*," no one with any wide experience of different qualities of coal gas will accept it as a "photometer or light-measure."

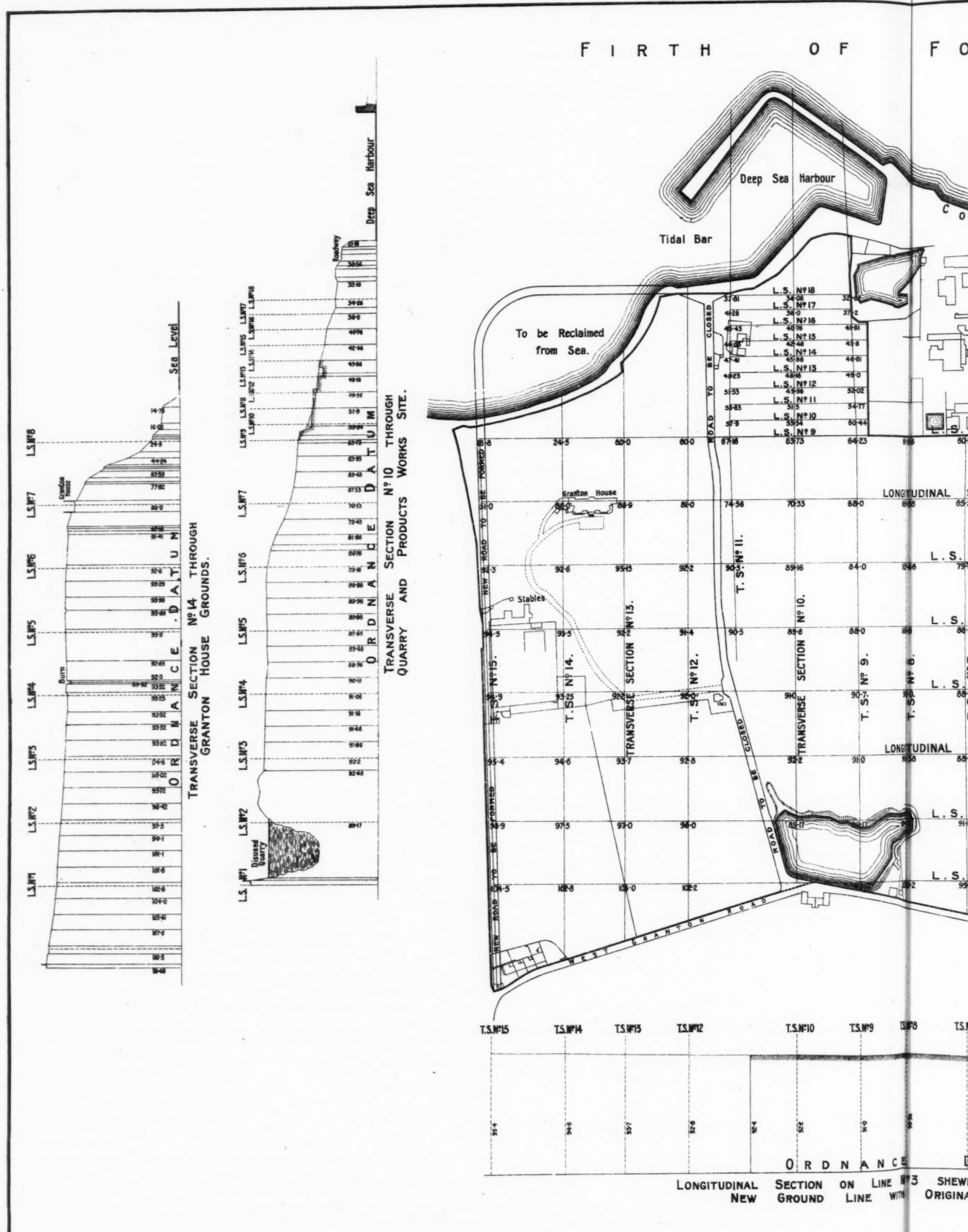
There is one, and only one, just method of employing the "London" argand as a test burner for different qualities of gas; and that is to allow it to develop the highest illuminating power which it is possible for it to educe from any particular gas. As Dr. Letheby remarked, in the quotation made by Professor Lewes, *gas companies are entitled to all the light which can be evolved from the gas by the burner*. Once let this proposition be frankly accepted (and its justness can hardly be denied), the testing of low-quality gas with the existing photometric apparatus presents no difficulties whatever. It is an axiom of gas lighting that the argand is developing the highest illuminating power when burning the greatest amount of gas that can be properly consumed. With the standard burner, this condition obtains with a flame of about 3½ inches high. As Professor Lewes points out, there is a little difficulty in exactly gauging the height of the flame, because of the forked or jagged shape it assumes. But this need offer no impediment, if it be specified that the burner is to be used at its maximum efficiency.

What such a rational method of testing would mean to gas companies, compared with the 16-candle flame method suggested by Professor Lewes, is shown by the subjoined table, in which each item represents the gas (neither improved by "enrichment" nor impoverished by "stripping" of its hydrocarbons) made from a different coal in a large experimental works, and tested against a Methven screen burning gas of constant quality.

Consumption of Gas for 3½-Inch Flame.	Illuminating Power Corrected to 5-Cubic Feet Rate.	Consumption of Gas for 16-Candle Flame.	Illuminating Power Corrected to 5-Cubic Feet Rate.	Difference. Loss of Light by 16-Candle Flame Method.
Cub. Ft.	Candles.	Cub. Ft.	Candles.	Candles.
6·76	14·64	5·90	13·56	1·08
6·38	14 73	5·75	13·91	·82
6·36	15·25	5·58	14·34	·91
6·28	15·45	5·57	14·36	1·09
5·76	15·80	5·24	15·26	·54
5·92	16·22	5·20	15·38	·84
5·97	15·90	5·20	15·38	·52
5·74	16·03	5·20	15·38	·65
5·95	16·30	5·12	15·62	·68
5·80	16 03	5·10	15·69	·34
5·78	16·26	5·10	15·69	·57
5·91	16·58	5·00	16·00	·58
5·48	16·60	4·94	16·19	·41
5·60	17·23	4·90	16·33	·90
5·63	16·70	4·85	16·50	·20
5·45	16·88	4·84	16·53	·35

Could the table be extended, so as to embrace still lower qualities of gas, probably more striking results would be shown, though, because of the great diversity in composition of gas from various coals, there can be no regularity in the extent to which different gases respond to the one method of testing as compared with the other. The results given are, however, sufficient to show that the adoption of Professor Lewes's method would do serious wrong to gas companies, who are clearly entitled to all the benefit that can be derived from the existing test-burner.

The Granton Works of the Edinburgh



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FORTH

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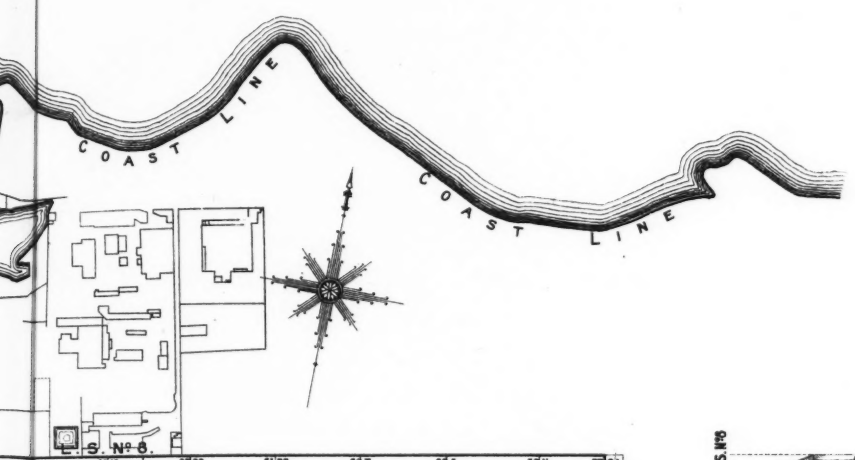
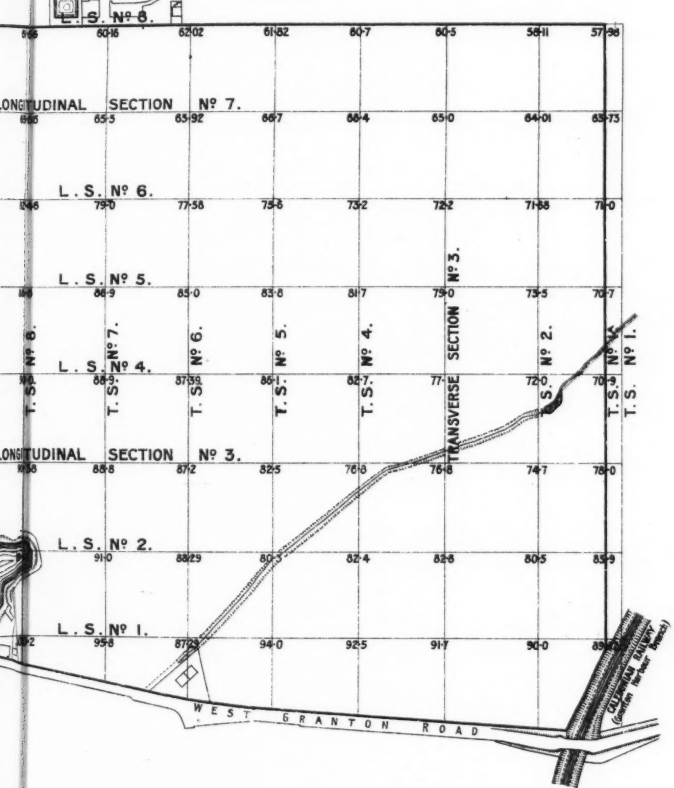
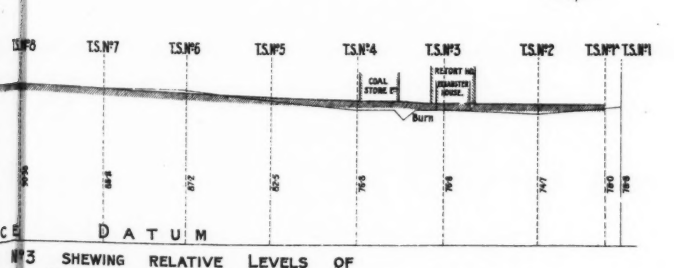
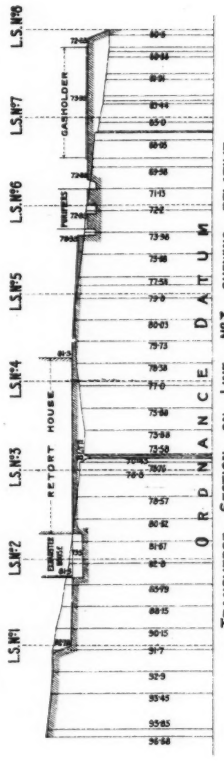


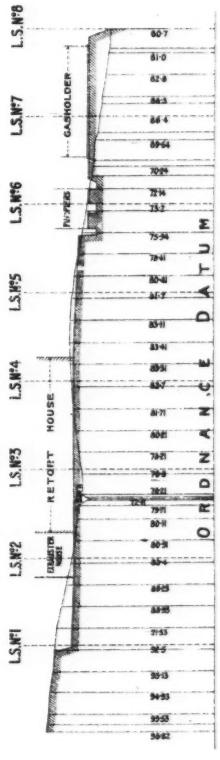




Nº3 SHEWING RELATIVE LEVELS OF ORIGINAL GROUND LINE.



TRANSVERSE, SECTION ON LINE Nº3 SHEWING RELATIVE LEVELS OF BUILDINGS AND PLANT.

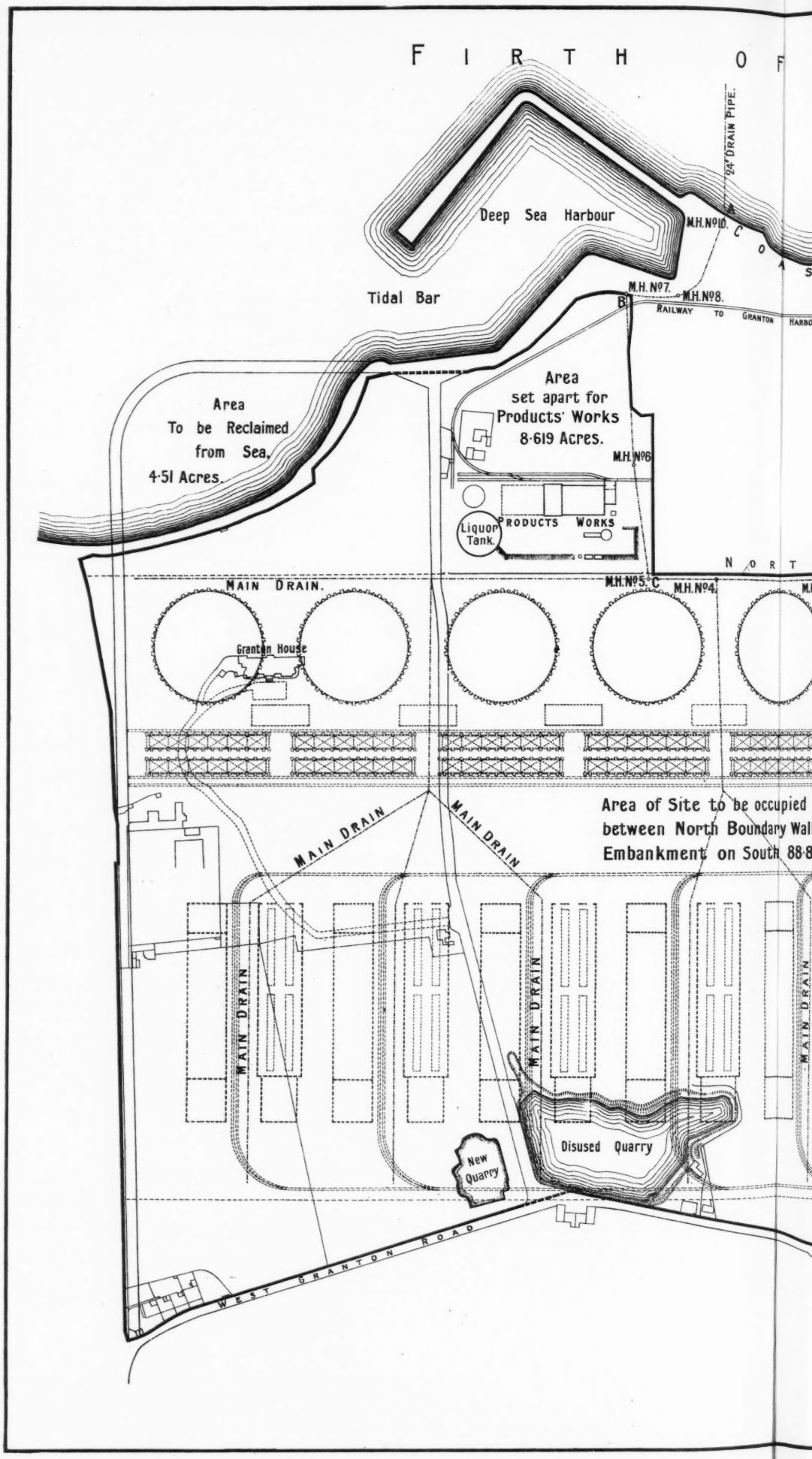


TRANSVERSE SECTION ON LINE Nº4 SHEWING RELATIVE LEVELS OF BUILDINGS AND PLANT.

WALTER RALPH HERRING,

M.INST.C.E., *ENGINEER.*

The Granton Works of the Edinburg



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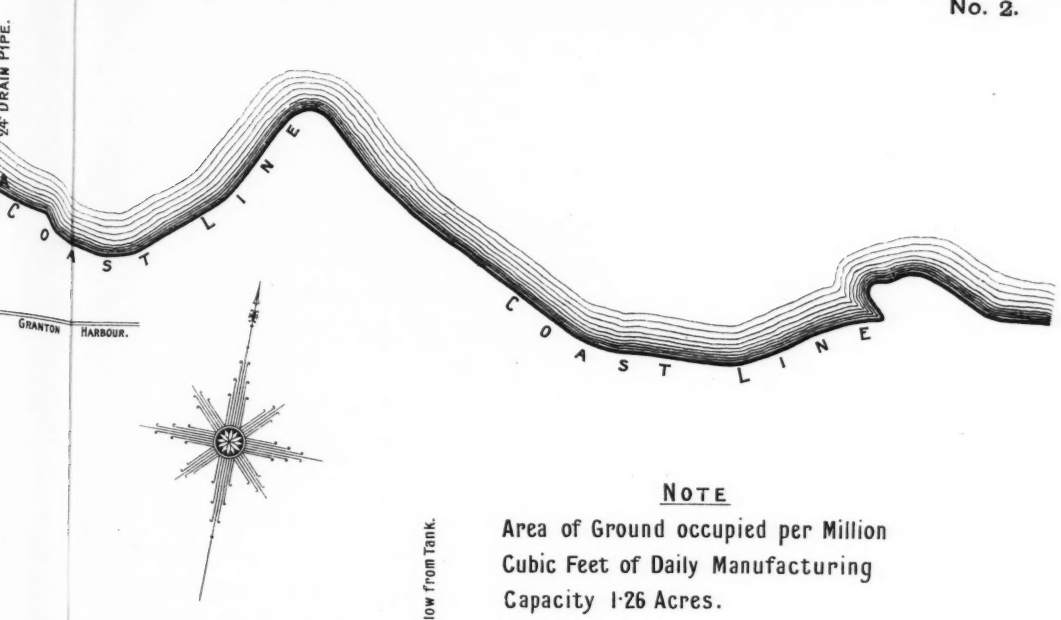
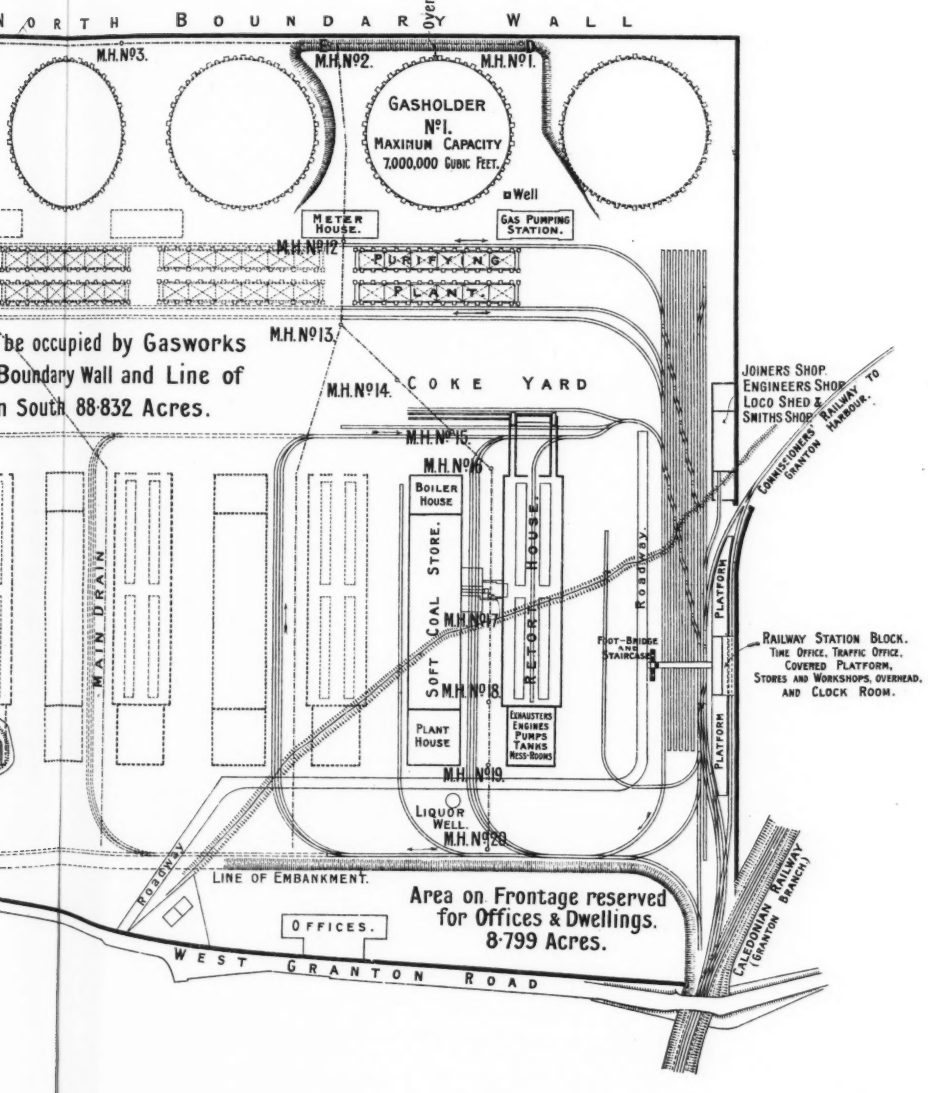


NOTE

Area of Ground occupied per Million Cubic Feet of Daily Manufacturing Capacity 1·26 Acres.



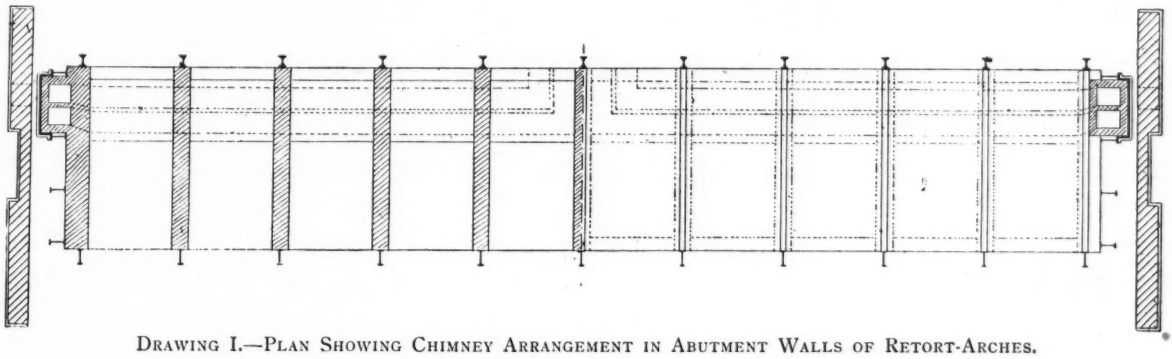
WALTER RALPH HERRING,

M.INST.C.E., *ENGINEER.*

AN INCLINED RETORT-HOUSE AND ITS WORKING AT BRISTOL.

THE searcher after truth and experience in the matter of the working of the inclined retort system will add to his facts and extend his knowledge by turning his attention for a brief space from the many installations in the North, the Midlands, and London and its suburbs, to an isolated example in the great south-western centre of commerce. This example attracts the student of the system from several points. In the annals of the Bristol Gas Company—long as has been their life, large as their works, and prosperous as they have been—the installation marks the first great departure from the system of hand working. This alone is sufficient to arrest attention; but when it is said that, notwithstanding this adherence to the old method of manufacture, the price of gas is, and was throughout the coal trouble, at the low figures of 2s. 1d. and 2s. 3d. per 1000 cubic feet, it will be seen that the inclined retort house which now stands loftily and proudly among its squat companions at the Avon Street station has something to do, to justify its existence. On this head more anon. Then, again, until the advent of the inclines, the field was not open, so far as the Bristol Gas Company are concerned, for the application of mechanical devices in the carbonizing operations; and now for the first time we see, in connection with this house, the coal landed, weighed, broken, elevated, conveyed, and carbonized, and the coke removed, without any handling other than by mechanical methods. Then, to the inquirer, the installation has an attraction from two points of its working—first, in regard to costs; and, secondly, in connection with the behaviour of the charges in view of the fact that, under (at the present time) some forty contracts, coal is used from three separate coal-fields—the Somersetshire, the Welsh, and the Midland. Further, there are a few interesting features in connection with the construction of the settings. All of which shows that here we have a most interesting example of inclined retort work to describe and invetsigate; and for the opportunity of doing this our thanks are due to the Company's Chief Engineer (Mr. D. Irving).

Before proceeding, it should be explained that the adapted house was formerly one of a range of three, and was occupied by ten beds of seven retorts, 20 in. by 15 in. by 18 ft. long, on the direct-fired system; and the time had arrived, after the winter's work of 1900-1, when the bench demanded reconstruction. The walls of the house itself are of Romanish strength and thickness; and therefore the question of discarding it was beyond contemplation. Thus, the problem that confronted Mr. Irving was a three-phased one—whether in this retort house the same system should be continued, whether machine stoking should be adopted, or whether the inclined system should be installed. Now, in regard to the first aspect of the question, the cost of hand labour for this house, under the old system, was considered, if not as excessive, as capable of improvement, calculating the expense from the taking of the coal from store to placing the coke in the yard. Time had produced its changes; and the figure of 35d. per ton of coal from store to yard could not—as the opportunity presented itself for making an effort to reduce it—be longer countenanced. Thus the old system was abandoned. Then, as to the adoption of stoking machinery, the size of the house—106 ft. long by 54 ft. wide—placed the idea outside the range of practicability. True, a great improvement could have been effected in the retort-settings, and the method of heating, by adopting regenerative settings; but this would have necessitated either a stage-floor or the sinking of generator pits. The former would not have been justified in view of the impossibility of applying stoking machinery, as, while there would unquestionably have been a saving in fuel, there could have been no reduction in the cost of labour for carbonizing. The sinking of generator pits, too, has its objections



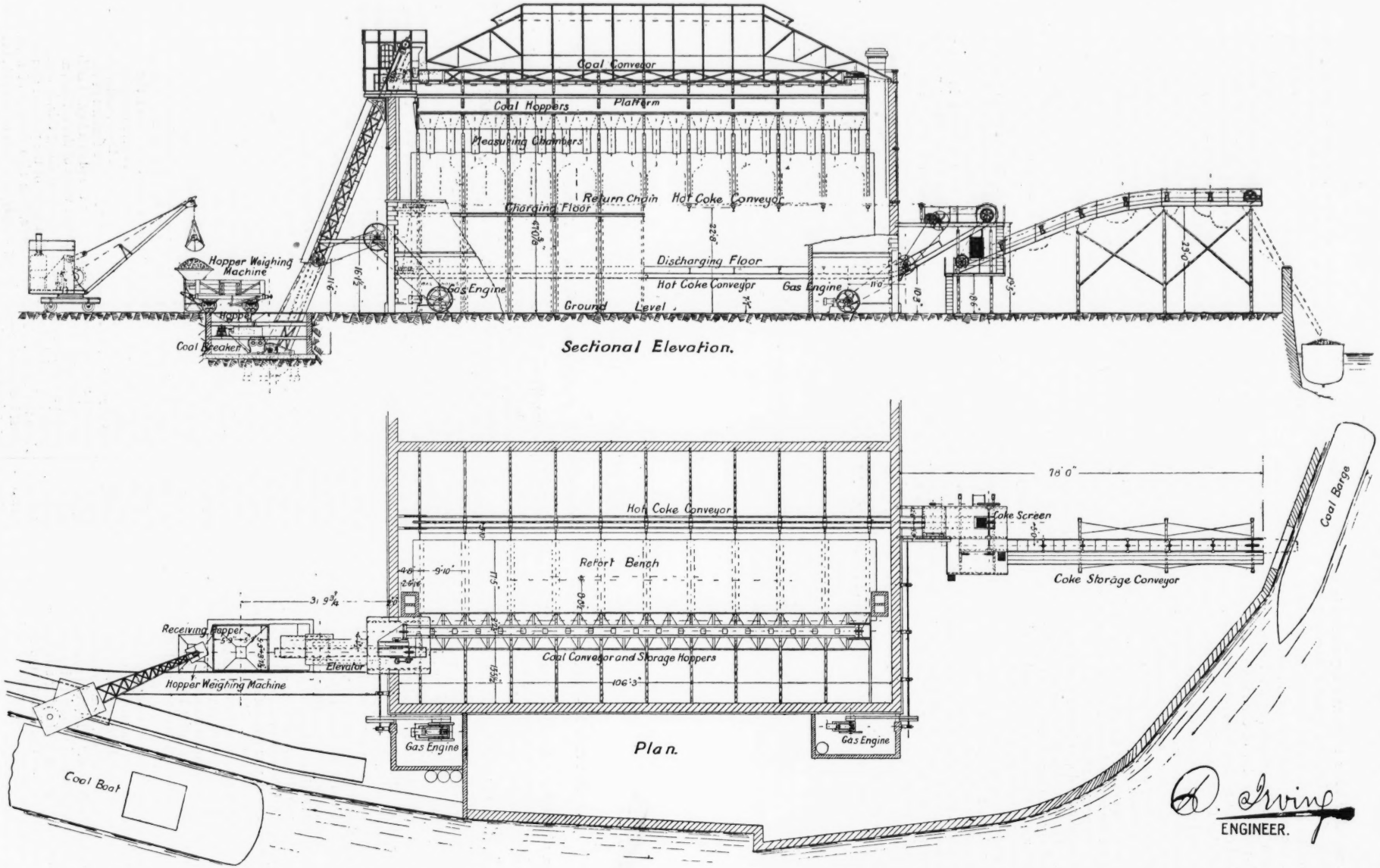
DRAWING I.—PLAN SHOWING CHIMNEY ARRANGEMENT IN ABUTMENT WALLS OF RETORT-ARCHES.

And so, after full consideration, it was decided to adopt inclined retorts. Therefore, here we have a case where the circumstantial environment of the house alone favoured the adoption of this system.

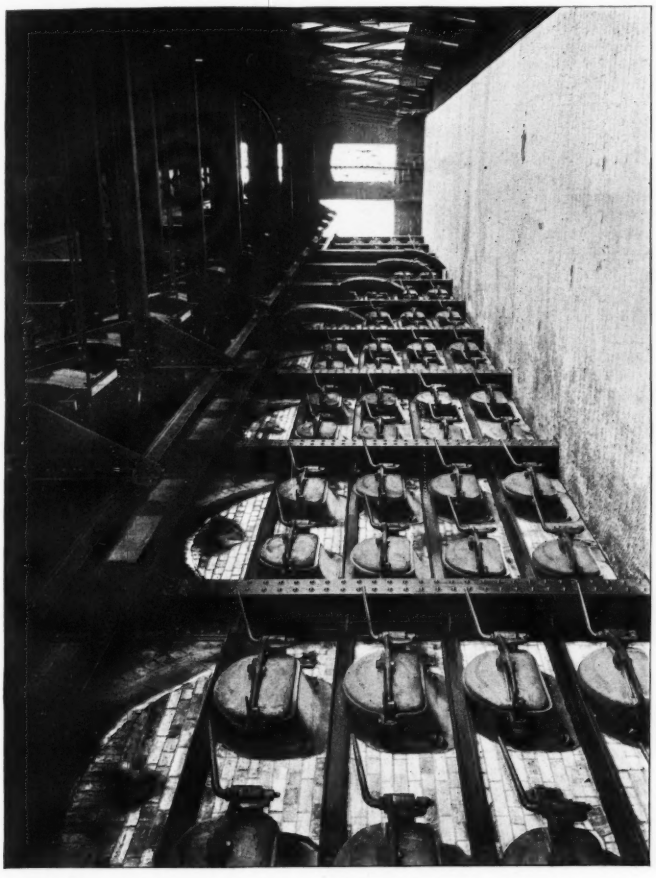
The decision to instal inclines determined the Directors, under the advice of their Engineer, to make the whole working of the house as complete mechanically as possible, by applying plant to deal with the coal right away from the holds of the vessels that carry it to the Avon Street station by way of what is known as "The Feeder," but which is really a Floating Harbour, connected to the tidal River Avon, and by also applying coke-conveying plant. Having said this, it is convenient to mention here that the work was divided into three sections. The first—the necessary structural alterations to the house, and the making of a quay for the landing of the coal—was carried out by the Company themselves. The second section, which consisted of the retort-settings and retort ironwork, overhead hoppers, measuring chambers, and shoots, was let to Messrs. Gibbons, of Dudley. The third contract, which comprised the coal breaker, elevator, and conveyor, and the hot-coke conveyor, was entrusted to the West Gas Improvement Company, of Manchester. It may be said that an inspection of the plant after twelve months' constant operation permits a confident expression of opinion that the character of the work upholds the reputation of the firms named.

Naturally, the house required considerable structural alterations to fit it for the inclined settings and the auxiliary plant. The then existing walls were only 25 feet high; and these were raised a further 25 feet. The old walls are built in pennant stone, and, like all the buildings of the Bristol Gas Company that we have seen, are of a very solid character. The new part is built of blue Staffordshire bricks which, as if to belie the name, we were told were "made in Bristol." The old roof was re-erected. With its round-nosed quoins and pennant sills and facings, the house presents a concordant and pleasing structure; and it is plentifully ventilated, and light. The situation of the house, too, contributes to the making of the conditions under which the men work extremely comfortable; and, in this respect, it stands well among the inclined retort-houses in this country. While dealing with the house, it may be mentioned that the stage-floors are reached by both external and internal stairways. The stages formed part of Messrs. Gibbons' contract, and are composed of rolled joists, cambered plates and concrete, paved with Staffordshire brick, cut diagonally. It may also be mentioned here that outside the house, the old coal-shed was cleared away and the new quay constructed—thus, as already indicated, permitting vessels to be discharged by mechanical means (to be described presently) alongside the house. This, as previously stated, was part of the work undertaken by the Company themselves.

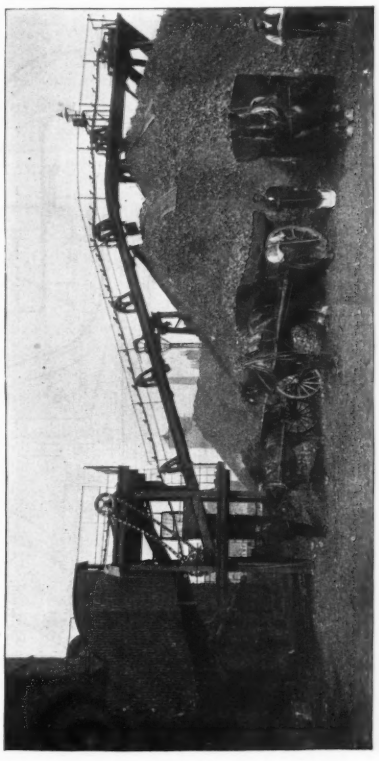
Coming now to the inclined retort-settings, they possess in and about them several points of much interest. There are ten beds of eight retorts, 24 in. by 14 in. by 20 ft. long, parallel, and of ⏢ section. They are set vertically in rows of fours—the idea being to secure the largest possible production out of the house, and the maximum amount of work out of the mechanical portion of the plant. One feature of the setting and furnaces is the arrangement of vertical blocks as patented by Mr. Irving and Messrs. W. P. & G. B. A. Gibbons. This particular system of building the settings was described and illustrated in the "JOURNAL" for Nov. 18, p. 1346; and the actual construction, as seen at Avon Street, presents to view a splendid compact body of work. Then the main flue is divided into two portions for the front and back of the settings; and practically the setting of each arch is divided into four sections, and regulated by four separate dampers—the front two and the back two being kept separate and distinct right through the main flue, and throughout the chimney. At Stapleton, this system has been found to give complete control in the working of the regenerative furnaces there, under the varying changes of wind and weather. Another feature of the setting is the economy of space derived by the plan adopted of building the chimney into the end abutment walls of the setting, as shown in the small Drawing I.—in fact, without doing this, it would have been impossible to have put ten beds of the present dimensions into the house. These chimneys, it is also worthy of note, are most inexpensive—consisting simply of 9-inch brickwork, braced by 3-inch angle-irons, and carried just above the ridge of the retort-house roof. Mr. Irving has had a long experience of the



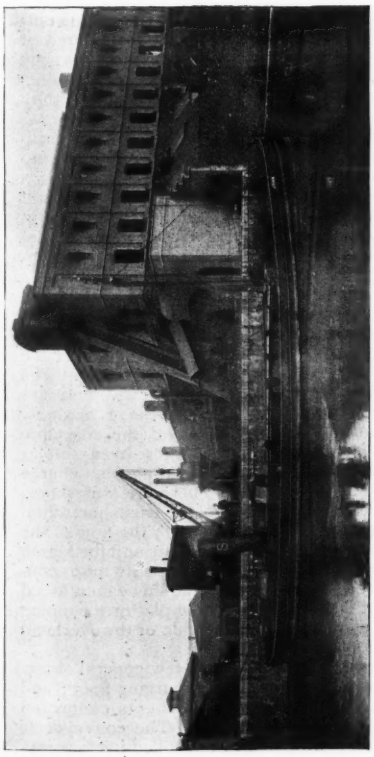
BRISTOL GAS COMPANY'S (AVON STREET WORKS) INCLINED RETORT INSTALLATION. ARRANGEMENT OF CONVEYING AND ELEVATING MACHINERY FOR COAL AND COKE.



CHARGING FLOOR, SHOWING OVERHEAD HOPPERS AND MEASURING CHAMBERS.

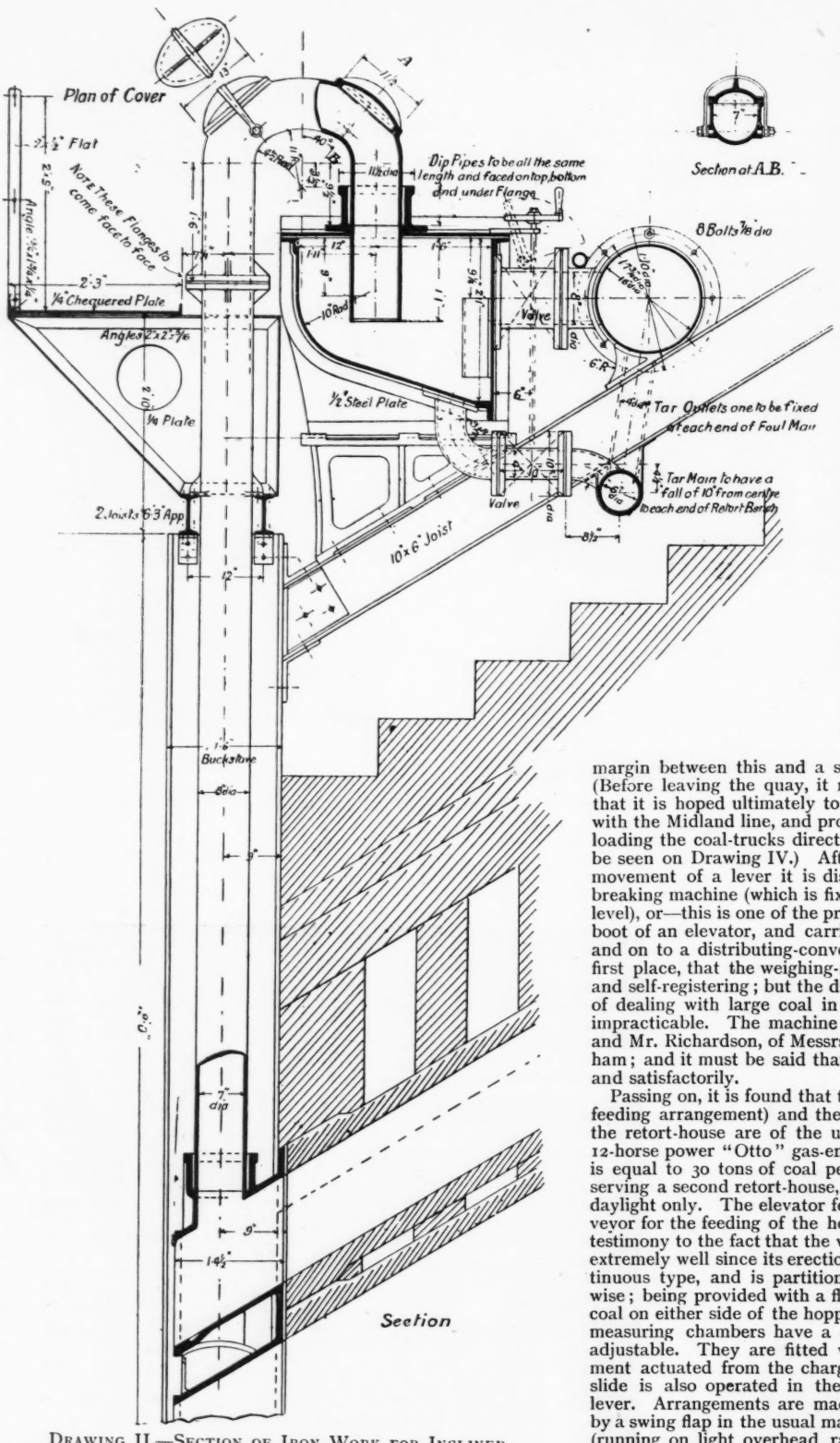


COKE-STACKING PLANT.



COAL UNLOADING, WEIGHING, BREAKING, AND ELEVATING PLANT.

DISCHARGING FLOOR, SHOWING DOORS TO HOT-COKE CONVEYOR FIXED UNDER FLOOR.


Plan of Cover
Section at A.B.
Dip Pipes to be all the same length and faced on top, bottom and under Flange
8 Bolts ⅞ dia
Note These Flanges to come face to face
2½" Flat
¼" Chequered Plate
Angles 2"x2"x⅜
¼ Plate
½" Steel Plate
Valve
Tar Outlets one to be fixed at each end of Foul Main
Tar Main to have a fall of 10" from centre to each end of Retort Bench
2 Joists 6·3 App.
10"x6" Joist
Buckstave
Section

DRAWING II.—SECTION OF IRON WORK FOR INCLINED RETORT BENCH.

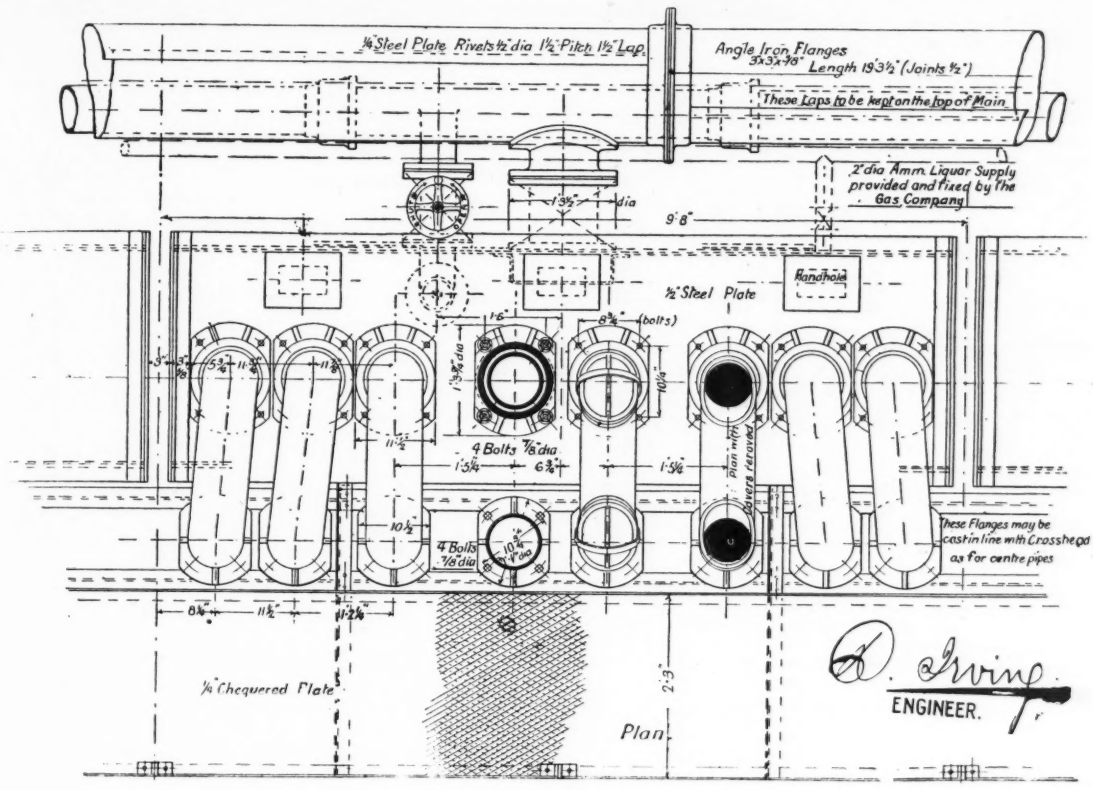
advantage in point of economy of this plan of building retort-house chimneys; he having adopted it at Stapleton quite ten years since. The fact that he has applied the system in the building of the inclines attests his view (after long experience) as to its value and efficiency.

Before leaving the settings, it was noticed that 7-inch ascension-pipes had been adopted. These, with the cross-heads, hydraulic main, caps, and other attachment details, are illustrated in Drawings II. & III.; and it will be observed that they present one or two original features—notably, the attempt to keep the weight of the ascension-pipes and the cross-heads off the mouthpieces (which, by the way, are of Tangye's make), and the method of securing the cross-head caps. Regarding the hydraulic main, provision has been made for taking off the tar, and for readily flushing out the main as often as required. The whole of the arrangements, as the drawing indicates, are very complete.

Now we come to the coal-handling plant; and it is seen that the same careful consideration that has been given to the details in the other portions of the plant is also found in this section of the work. (See p. 30.) This house and its situation offer exceptionally good facilities for making provision for the economical handling of material; and the Engineer (supported by his Directors) has made excellent use of the opportunity. The coal is received alongside the new quay in small steamers and trows, which are unloaded by means of a steam-crane and Hone's grab. The crane is a 5-ton one, and was supplied by Stothert, of Bath; and the grab, of 15 cwt. capacity, was made by the Thames Iron-Works and Shipbuilding Company. The crane and grab are equal to dealing with 30 tons of coal per hour. The grab discharges into a hopper weighing-machine, which also possesses features of interest, and moreover certain features that are new. It has a capacity of 25 cwt., so that there is really a respectable margin between this and a single delivery from the grab. (Before leaving the quay, it may be incidentally remarked that it is hoped ultimately to secure a railway connection with the Midland line, and provision has been made for unloading the coal-trucks direct into the coal-breaker, as will be seen on Drawing IV.) After the coal is weighed, by the movement of a lever it is discharged either into the coal-breaking machine (which is fixed in a pit below the ground level), or—this is one of the projects for the future—into the boot of an elevator, and carried direct into the coal-store, and on to a distributing-conveyor. It was proposed, in the first place, that the weighing-machine should be automatic and self-registering; but the difficulty (Mr. Irving points out) of dealing with large coal in such a manner rendered it impracticable. The machine was designed jointly by him and Mr. Richardson, of Messrs. W. & T. Avery, of Birmingham; and it must be said that it works very trustworthily and satisfactorily.

Passing on, it is found that the coal-breaker (with its self-feeding arrangement) and the bucket elevator leading into the retort-house are of the usual West type, driven by a 12-horse power "Otto" gas-engine. This part of the plant is equal to 30 tons of coal per hour; and it is capable of serving a second retort-house, and that during the hours of daylight only. The elevator feeds on to a scraper coal-conveyor for the feeding of the hoppers. The Engineer bears testimony to the fact that the whole of this plant has worked extremely well since its erection. The hopper is of the continuous type, and is partitioned longitudinally and crosswise; being provided with a flap arrangement to deliver the coal on either side of the hopper as may be required. The measuring chambers have a capacity of 7 cwt., and are adjustable. They are fitted with a simple lever arrangement actuated from the charging-stage; and the charging-slide is also operated in the same manner by a similar lever. Arrangements are made for regulating the charge by a swing flap in the usual manner. There are four shoots (running on light overhead rails), one for each horizontal tier. They are of very simple construction; the flow of the charge being regulated merely by a baffle-plate and the action of the slide-levers by the men, who have really more control over the charge than the shoot itself. It should be mentioned that all the overhead plant is accessible from a platform running the full length of the house, and fixed on the side of the overhead coal-hopper.

Continuing the description before making a few general observations on the plant, we will descend to the discharging-floor; and there the position occupied by, and the arrangements connected with, the hot-coke conveyor claim attention. The conveyor is placed under the floor; and is attached to the rolled joists carrying the latter. When discharging is not in progress, the whole is covered in by a continuous row of plate trap-doors, as shown in the photograph; and, as the discharging proceeds, they are opened and closed as necessary. When open, they form both a screen


¼" Steel Plate Rivets ½" dia 1½" Pitch 1½" Lap
Angle Iron Flanges 3"x3"x⅜" Length 19'3½" (Joints ½")
These Laps to be kept on the top of Main
2" dia Ammn. Liquor Supply provided and fixed by the Gas Company
9'8"
Ranahold
½" Steel Plate
4 Bolts ⅞" dia
4 Bolts ⅞" dia
Plain with Covers removed
These Flanges may be cast in line with Crosshead as for centre pipes
¼" Chequered Plate
Plan
ENGINEER.

Drawing III.—Plan of Ironwork for Inclined Retort Bench.

and a shoot—shielding, on the one hand, the men from the heat of the incandescent coke, and, on the other, directing the heavy spent charge on to the conveyor. Furthermore, the remaining trap doors being closed, the coke is carried away by the conveyor practically under cover; the result being that the heat is minimized, and the discharging-floor is as free from the steam resulting from the quenching as a retort-house can possibly be, and as is any inclined retort-house that has come under our observation. This is a great protection to the men, and contributes immensely to their comfort. The trap-doors are made of ½-inch wrought-iron plates. The trough of the conveyor is 1 ft. 8 in. deep in the clear below the girders, and 2 ft. 3 in. broad, and is constructed of channel-irons and wrought-iron plates. The operating part of the conveyor consists of Hunt's patent chain, carried on T-iron wearing strips. The return chain is carried overhead on light girders fixed to the buckstays and the retort-house wall. Quenching is accomplished by the sprinkling of water from pipes fixed throughout the whole length of the trough, which are regulated from the discharging-floor. The coke is then delivered, up an incline of 30°, on to a fixed screen, which removes the breeze, and from which it is transferred to the elevated storing conveyor in the yard (as shown in one of the illustrations)—being deposited where required through levered openings. This outside conveyor is 75 feet in length, and 23 feet high from the ground. The coke could also be readily delivered from the conveyor into barges, were it not for the risk from fire involved in loading hot coke direct in this way. However, it is apparent that this is a matter that need not trouble the Company or their officials, so far at all events as this station is concerned, as the yard is free from coke, save for the heap of limited bulk immediately under the conveyor, which heap supplies an easy descent for the falling coke. Neighbouring works relieve the station of the greater part of its coke production by carts, which are filled and hauled away without cost to the Company. The coke plant is arranged to be driven by means of an 8-horse "Otto" gas-engine.

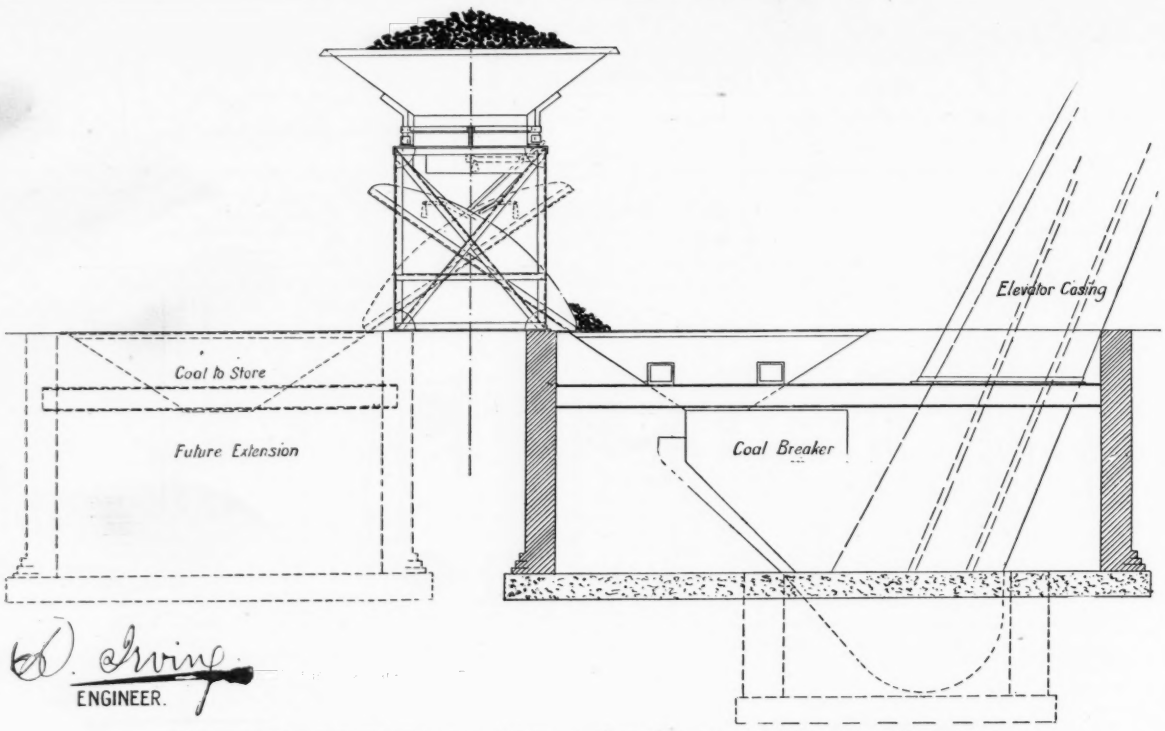
This completes the description of the first incursion of the Bristol Company into the latest accepted field of carbonizing operations and methods of dealing with raw and spent materials; and the experience of the working over a complete twelve months—in respect of the smoothness and regularity of the operations, the freedom from anxiety, and the saving in working costs—enables us to confidently say that this will be found, as opportunity offers, to be but the beginning of a great change in their manufacturing plant. The old order of things has served the Company well; but the changes which late years have effected in directions well known to the gas engineer have demanded recourse in these as in other large gas-works to modern developments, and the demand will grow. This being so, it is a satisfaction to learn that the Engineer of the Company and the Superintendent of the Avon Street station (Mr. W. Stagg) are gratified, after their twelve months' experience, with this innovation in the Company's working. After the first few insignificant hitches which invariably accompany the setting to work of a large plant of this character, they have practically had no trouble; and consequently—supported by the influential factor of lessened working costs—there need be no hesitation in saying that, when the occasion presents itself for further conversion (the conditions of the adjoining houses being comparable and favourable), the Company will prove their adherence and preference for the inclined system by repeating the work which we have had the opportunity of describing.

In the twelve months, the bench has been under continuous work, and something like 40,000 tons of coal have been carbonized in it, or 500 tons per retort; so that the extent of their operation and the resulting experience cannot be called in question. The testimony as to the regularity and easy course of the whole of the operations is confirmed by our own observation on a recent visit. The coal was seen lifted from the hold of a vessel in the adjoining waterway, then weighed, registered, passed through the coal breaker, elevated, and conveyed to the hoppers, and a number of retorts were charged—expedition, preciseness, and pleasing ease of movement characterizing the whole of the operations from beginning to end. The men on the charging-stage, too, gave proof of the simplicity of their duties by charging a number of retorts with 7 cwt. charges in a space of time so small that to mention it would excite incredulity. The heats of the settings and the charges in the retorts were beyond reproach, notwithstanding the mixture of coal we saw being used; and there was uniformity in these respects from the bottom to the top retorts. This and the other experience runs on uninterruptedly from day to day. One matter we had almost forgotten to mention is that the whole of the work, which gives these gratifying results, and about which there is everywhere an air of completeness that convinces as to the care exercised in all matters of constructional detail, was started and completed within nine months in 1901.

Now we come to the part of our account of this installation that will be critically studied, and, we think, will prove of service—that is with regard to the cost of work in this installation. First, it should be remarked that, when reserve coal is being worked from the stores, the cost is, of course, increased; hence the necessity for having regular supplies to secure the most economical working.

Labour Costs.

Charging and discharging . . .	=	8·44d.	per ton carbonized.
Engines, elevators, &c.	=	1·50	,, ,,
Producers	=	1·69	,, ,,
Hopper attendant.	=	0·48	,, ,,
		12·11d.	,, ,,



Drawing IV.—Hopper Weighing Machine, Coal Breaker, and Proposed Extension.

The retorts are, as explained, worked with 7 cwt. charges of six hours duration, being equal to 28 cwt. per 24 hours, or 112 tons per diem for the ten settings. The above statement includes the labour of handling and carbonizing the coal, from the reception of the coal into the breaker until the coke is cooled and stacked in the yard. The cost of doing practically the same work under the pre-existing arrangements with hand labour, amounted to 35d. per ton of coal carbonized. Before any fair comparisons between the cost of carbonizing a ton of coal under the old and new *régime* in this particular retort-house can be made, the cost of construction and the additional annual charge of such costs, together with the cost of depreciation and renewals, must be added to that of the labour cost. The matter of retort renewals is taken in this comparison as equal to that of ordinary retorts, heated by direct fires, which at these works have a life of from 600 to 1000 days. The installation having only been in action a little over a year, the exact costs in this respect cannot, of course, be given; and, even if they could, the first year would not supply a fair idea of the wear and tear charges, which are as yet very small. The Avon Street works being fairly large, there is no difficulty about keeping the installation running summer and winter as long as it is able to work; and, when so running, the quantity of coal carbonized will equal (as it has done during the past year) 40,000 tons of coal per annum. The cost of the installation as described was about £14,000.

£14,000 at 4 per cent. interest	=	£560
Buildings, &c., £10,000 at 2½ per cent. depreciation.	=	250
Machinery, &c., £3000 at 15 per cent. do. .	=	450
Annual charges	=	£1260

Or 7·56d. per ton of coal carbonized.

This statement is compiled, in order to show that the advantages of inclined retorts under such conditions as exist in this particular works, are such as to warrant a comparatively large expenditure upon judicious reconstruction, and yet leave a profitable margin over and above the costs of hand-stoking and ordinary retorts. Most practical men no doubt will think that the annual charges given above are very much overstated; and this must at once be admitted. The 15 per cent. allowed for machinery will practically provide for the annual renewal of most of the working parts of the plant. Obviously, in supplying us with these figures, Mr. Irving was desirous that the advantages and economies of inclined retorts should not in any way be exaggerated.

Considering this comparison, it must be borne in mind that, in the cost of working ordinary retorts, nothing whatever is added for interest or depreciation; so that the comparison is altogether in favour of the old system. The cost figure of 35d. per ton of coal carbonized includes the work already described under the head of carbonization, and is practically the same for hand labour at each of the three works of the Company. It will also be noted that Mr. Irving confines himself to the comparative cost of doing certain definite work—viz., the cost of labour, on an ordinary working day, in taking the coal upon the works, carbonizing, and placing the remaining coke in the coke-yard—cooled and stacked. Nothing is claimed in the statement for the obvious saving of cost in unloading vessels, or for the increased quantity of coke for sale that must follow the introduction of generator furnaces into the works.

Inclined Retorts.

Labour	=	12·11d.	per ton of coal carbonized.	
Interest and depreciation	=	7·56	,,	,,
Sundries	=	0·33	,,	,,
		20·00d.	,,	,,
Ordinary Retorts.				
Labour only	=	35·00	,,	,,
		15·00d.	,,	,,

And this profit of 15d. per ton of coal carbonized can be guaranteed for every day the installation is kept in full work. With regard to the manufacturing results, there has been an increase in the gas made and in the coke available for sale, and a very slight reduction in the tar made, per ton of coals, at these works, during the past twelve months, compared with 1901.

It has been often stated, and with some show of truth, that the economy in working inclined retorts, and also in the use of stoking machinery, is all, or nearly all, obtained from the labour-saving appliances used for bringing the coal to the retorts, or taking away the coke. This, however, is not the case with inclines. The cost of simply charging and drawing ordinary retorts by hand labour at Bristol, including the working of the producers or direct fires, amounts to 24d. per ton of coal carbonized. The cost of doing the same work in inclined retorts is 10·13d., or a reduction of 13·87d. per ton of coal carbonized. Or the comparison can be given on a weight-basis, which eliminates any variations in the rate of wages—

Hand work equals	52·5	cwt.	per man.
Inclines ,,	124·4	,,	,,

The cost of moving material by hand, exclusive of carbonizing—viz., placing the coal in the retort, and withdrawing the residual coke—from the coal-stores (not reserved coal), and placing the same in the retort-house ready for charging, and the removal of the coke made from this same coal, amounts to 9·71d. per ton of coal. The cost of doing the same work with the mechanical arrangements as described, amounts to 1·98d. per ton of coal carbonized. From these figures readers will observe not only the saving effected, but the particular portion or section of work in which the saving has been obtained.

In supplying, during a recent visit to Bristol, much of the information on which this article has been based, Mr. Irving has given to his professional colleagues definite experience with the inclined installation over a complete year, and his great anxiety was that there should not be any semblance of exaggeration in the statements published. Therefore, what is here recorded may be taken as a plain recital of facts as observed and imparted to the writer during a few interesting hours spent by him at Avon Street works. Mr. Irving also expressed his warm acknowledgment of the kind and generous manner in which a number of gas engineering friends on the Continent and in this country permitted him to inspect their works, more especially Mr. Wilton, the Engineer of the Bow Common works of the Gaslight and Coke Company.

TECHNICAL RECORD.

THE GAS INDUSTRY AND THE MANUFACTURE OF CYANIDE.

The "Revue Générale de Chimie Pure et Appliquée" for the 19th ult. contains the first portion of an article on the above subject, by MM. Robine and Lenglen. It is intended as an introduction to one which is to follow, dealing with the various processes at present applicable to the extraction of the cyanogen compounds in coal gas, ammoniacal liquor, and spent purifying materials. It necessarily partakes of the nature of a recapitulation of what has already been published on this question; but it may nevertheless be of interest to give an abstract translation of the communication.

The authors begin by pointing out that the cessation of hostilities in South Africa will make it possible to resume work in the gold mines. Indeed, this has been done to a certain extent; and before long all of them will again be fully employed. With this general resumption of labour, there will be a corresponding new flow of business, which will enable Continental manufacturers to dispose of the stocks they had been compelled to allow to lie idle during the war. This renewal of activity will introduce the interesting and long-studied problem of the economic industrial manufacture of cyanides. South Africa, like all gold-yielding countries, consumes a large quantity of cyanide of potassium, nearly all of which is furnished by Germany and England. Owing to competition, France remains in the rear, because the economic conditions of manufacture are unfavourable. The question is, however, worthy of more attention than it seems to have had. There are at present in existence three systems of manufacture of cyanides on a commercial scale: (1) The transformation of ferrocyanides into cyanides by alkaline metals or their alloys; (2) the synthetic process, by the action of atmospheric nitrogen on carbon in the presence of an alkali or alkaline metal, or by the action of ammonia on an alkaline metal alone or mixed with carbon; and (3) the extraction of cyanides as bye-products in the manufacture of gas. As a complete study of all these methods would lead the authors too far, they restrict themselves to dealing with the third.

During the last thirty years, the manufacture of illuminating gas has, as is well known, developed considerably in England, France, and Germany. Now, the cyanogen compounds are to be found ready formed in this gas, though, it is true, the percentage is rather low—sometimes almost at zero. But when the enormous quantities of gas made in various countries every year are considered, it is easy to see that those who are engaged in this industry furnish a very profitable source of these compounds. Moreover, cyanogen is a deleterious product, from which the gas should be freed before it is supplied for consumption; and consequently there is an absolute necessity, as well as an advantage, in extracting it, which can be done the more easily as it forms naturally during the process of manufacture.

In England first, and subsequently in Germany, this subject of the recovery of the cyanogen compounds attracted much attention, and manufacturers and scientists immediately recognized the amount of profit which could be derived from this idea in coal and gas producing countries like these. In France, on the contrary, as already remarked, but little attention seems to have been devoted to the matter; and even at the present time not much interest is evinced in extending the industry, notwithstanding the fact that in France 4,000,000 metric tons of coal are utilized annually for the production of gas, each ton yielding easily extracted products worth about 2 frs., which would realize the sum of 8,000,000 frs. (£320,000)—a by no means negligible amount. However, an objection may be raised that many French gas-works are small, and the bye-products not of much value. To this it can be replied that most works belong to influential companies who own several; and it would therefore be quite easy for them to combine in some general scheme by which the whole of the products could be conveyed to central works for treatment, or sold to manufacturers for this purpose.

With these few preliminary considerations, the authors proceed to describe in detail the process of the formation of the cyanogen compounds during the manufacture of coal gas. They show that the distillation of coal in closed vessels results in the following products: (1) Illuminating gas, (2) coke, (3) tar, (4) ammoniacal liquor, and (5) spent purifying materials. The proportions of these products vary, of course, with the kind of coal employed, the duration and number of charges per 24 hours, and other conditions. Under ordinary circumstances, and with the usual coal, the following are the yields per 100 kilos. of raw material: Coke, 70 kilos. (about 1½ cwt.); tar, 3·5 to 6 kilos.; ammoniacal liquor, 6 to 9 kilos., of 1° to 8° Baumé, corresponding to 1 to 5 per cent. of pure ammonia; and gas, 30 cubic metres (1060 cubic feet). As only three of the products—the gas, the ammoniacal liquor, and the spent purifying material—are of any interest in connection with their investigation, the authors deal with them successively. They first of all review the various theories put forward with regard to the formation of cyanogen compounds in the manufacture of coal gas, and show what are the reactions which may determine it. They point out that cyanogen compounds are formed naturally in the above-named process, and may be met with in the various operations in the following forms: Cyanogen, sulphocyanogen, sulphohydrocyanic acid, hydrocyanic acid, cyanide, ferrocyanide, and sulphocyanide of ammonium. The nitrogen requisite for the formation of these compounds originates in the coal, which contains various proportions according to its species—an average of from 1 to 1·60 per cent. The operation of distillation distributes this nitrogen among the various products, and only a small quantity is found in the state of cyanogen compounds. The late Professor Foster some years ago studied the migrations of nitrogen that occur in distilling coal in a closed vessel.* His experiments dealt with coal containing 1·73 per cent. of nitrogen; and he found that of this quantity 0·251 per cent. passed to the state of ammonia, 0·027 per cent. to the state of cyanogen, 0·863 per cent. remained in the coke, and 0·589 per cent. passed to the tar and gas. Herr Knublauch, who made similar experiments with three samples of coal, found the total nitrogen to be: (1) 1·555, (2) 1·479, (3) 1·176; the nitrogen in the form of cyanogen being respectively 0·0268, 0·0278, and 0·031. Herr Leybold shortly afterwards gave the percentage of nitrogen contained the following products as: Coke, 31 to 36; ammonia, 10 to 14; cyanogen, 1·5 to 2; tar, 1 to 1·3; and gas 46 to 56.† Reckoning Mr. Foster's total nitrogen as 100, the quantity passing to cyanogen was 1·56 per cent., while in the three samples of Herr Knublauch, similarly dealt with, it was 1·8. These figures show that the percentage of cyanogen compounds is relatively low; and therefore they could not be rendered profitable unless large quantities of coal were treated. The proportion depends mainly upon the temperature of distillation; cyanogen only being engendered in brisk distillations at a high heat. By carbonizing coal at a high temperature, Mr. Foulis found that 2·831 litres of gas gave 6·5 grammes of cyanogen; while at a low temperature the proportion decreased by more than one-half. According to Mr. Hunt, the most favourable temperature for the formation of cyanogen is 950° C. and upwards; and at 700° to 800° C. the amount is as much as twelve times less. This remark is confirmed by the fact, experimentally demonstrated, that the main portion of the cyanogen is formed towards the end of the distillation—*i.e.*, when the temperature is greatest; the amount of ammonia produced at this time being very slight. A small percentage of cyanogen, therefore, always corresponds with a high percentage of ammonia, and *vice versâ*. M. Perthuis made in 1895 a number of experiments which clearly demonstrate that such is the case, and that the production of cyanogen attains its maximum at the end of the distillation, whereas at the beginning it is almost *nil*.

The state in which the cyanogen leaves the retorts has caused much discussion, and opinions vary greatly. Some people maintain that it exists in the gas as cyanide and sulphocyanide of ammonium, which, meeting with sulphur and suphide of carbon in the retort at a high temperature, would be partially transformed into sulphocyanide of ammonium. But, on the other hand, experiments conducted by Herr Bergmann clearly demonstrate that the action of ammonia on carbon or carbonic oxide at red heat does not give cyanide of ammonium, but hydrocyanic acid. According to Mr. G. P. Lewis,‡ this is the most probable result. The cyanogen in the gas cannot exist there except as free cyanogen or free hydrocyanic acid. He bases this view on the following principles: (1) Cyanogen cannot possibly exist in the gas in the form of sulphocyanic acid (CNSH); the latter being decomposed, in presence of hydrogen, into hydrocyanic acid and sulphuretted hydrogen. (2) It cannot exist as cyanide of ammonium, this salt being decomposed as soon as the temperature exceeds 26·6° C. (3) It is just as improbable that it is in the form of sulphocyanide of ammonium; experiments having clearly demonstrated this. Finally, other authors admit that cyanide of ammonium is formed, but that it is decomposed by the carbonic acid contained in the gas which would produce hydrocyanic acid and carbonate of ammonia. This explains the absence of cyanide of ammonium in the scrubbers. However it may be, formation of the cyanogen compounds takes place in the retorts at a high temperature, and probably results from the action of ammonia or carbon or carbonic oxide—an action which determines the formation of free hydrocyanic acid, which during its migrations through the various appliances is transformed. Cyanogen is found in ammoniacal liquor chiefly in the form of ferrocyanide and sulphocyanide of ammonium; the latter being only met rarely, and as an adjunct. Ferrocyanide of ammonium, according to Mr. Lewis, is due to the action of free hydrocyanic acid, in presence of ammonia, on sulphide of iron; being itself produced by the action of sulphuretted hydrogen on the iron frame of the condenser. With regard to sulphocyanide of ammonium, its origin is a little more obscure, and demands some further explanations. However, Mr. Lewis thinks, not without reason, that it is caused by the reaction of sulphide of carbon on sulphide of ammonium, the sulphide being itself produced by the action of the sulphur of the pyrites contained in the coal on the carbon at the distillation temperature.

* See "JOURNAL," Vol. XL., pp. 1081, 1124.

† An article dealing with the investigations of Herr Knublauch will be found in the "JOURNAL," Vol. LIV., p. 832; and those of Herr Leybold were noticed in Vol. LVI., p. 1048.

‡ See "JOURNAL," Vol. LXIX., p. 1049.

The percentage of ferrocyanide and sulphocyanide of ammonium contained in ammoniacal liquor is relatively very slight. The average given by Mr. Lewis is 181 grammes of ferrocyanide and 286 to 907 grammes of sulphocyanide per ton of coal distilled. Herr Esop gives the following figures of experiments made at the gas-works of Wiesbaden, Karlsruhe, and Mayence:—

Sulphocyanic Acid.	Ammonia.
1·22 per cent.	18·05 per cent.
1·51 ,, ,,	19·03 ,, ,,
2·33 ,, ,,	36·05 ,, ,,

Dr. Lunge says the amount of sulphocyanide of ammonium contained in ammoniacal liquor in English gas-works amounts to 11 kilogrammes per 454 litres; though Mr. Playfair could never find more than 0·453 kilo. in this quantity. There is no reason to be surprised that ferrocyanide and sulphocyanide of ammonium, although both very soluble in water, exist in such small amounts in ammoniacal liquor, as this is merely due to the action of the carbonic acid, which decomposes these salts. On the contrary, we find cyanogen almost completely retained in the purifying material, and if we consult the table given by Mr. Lewis, it is easy to see that immediately after the passing of the gas into the first purifier, the amount of cyanogen products contained in it, which previously varied very little, decreases considerably, and that it is in the first purifier that the principal portion of the cyanogen products are formed. Herr Leybold had made similar experiments, demonstrating the progressive elimination of the cyanogen.

The purifying material consists of a mixture of ferric hydrate and sulphate of lime obtained by the reaction of lime on the ferrous sulphate—a mixture made porous by sawdust. The gas entering the purifiers contains sulphuretted hydrogen, ammonia, and cyanogen compounds. Somewhat complex reactions take place between the purifying material and these impurities, and, in particular, ferrous cyanide, ferrocyanide of iron, and ferrocyanide and sulphocyanide of ammonium are formed. Formation of the ferrocyanide can be explained in various ways. The hydrocyanic acid acts on the iron oxide to form ferrous cyanide, which in the presence of the oxygen of the air is transformed into prussian blue. But it results from Herr Leybold's experiments that if a current of hydrocyanic acid mixed with hydrogen is conveyed through the purifying materials, nothing is absorbed; whereas if the material is first saturated with sulphuretted hydrogen, the hydrocyanic acid is all combined, owing to the previous formation of sulphide of iron—the ferrous cyanide formed being subsequently transformed into prussian blue under the influence of atmospheric oxygen. Finally, others admit that the ferrous cyanide results from the action of cyanide of ammonium on oxide or sulphide of iron; and if the cyanide of ammonium is in excess, there is formation of ferrocyanide of ammonium. However this may be, the prussian blue is not formed direct in the purifiers, but by oxidation of the ferrous cyanide.

Humidity and the employment of steam favour the formation of ferrocyanides, and ammonia prevents it. Thus it is very important, when material rich in ferrocyanide is needed, to wash the gas as completely as possible, to free it from ammonia. Herr Knublauch succeeded, by almost completely removing ammonia from the gas, in obtaining materials containing as much as 24 per cent. of ferrocyanide. As a fact, ammonia greatly favours the production of sulphocyanides of ammonium or of iron. Herr Knublauch first demonstrated in 1877 the close relation between ammonia and sulphocyanogen and the formation of sulphocyanides at the expense of the ferrocyanides. If the gas has been sufficiently washed, sulphocyanide of ammonium only exists in a very small quantity when it reaches the purifiers; but it may be engendered in large percentages in these appliances, especially when the ammonia or sulphide of ammonium is in presence of free sulphur finely divided, as it exists in old sulphuretted hydrogen purifying material. Herr Leybold studied this phenomenon, and analyzed two samples of purifying material, saturated with sulphuretted hydrogen, which had been subjected to the action of a mixture of hydrocyanic acid and sulphide of ammonium—

	$HCN+NH_3$.		$HCN+(NH_4)_2S$.
Water	23·60	..	33·02
Sulphur	24·98	..	11·39
Prussian blue	1·70	..	5·38
Sulphocyanide of ammonium	3 03	..	4 40
Ammonia	2 05	..	0·75

From these analyses it results that in the case of ammonia the proportion of sulphocyanide formed is greater than that of prussian blue, and almost equal to sulphide of ammonium. Presence of an alkali in the material also greatly favours the formation of sulphocyanides. During revivification of these materials, unless care is taken to prevent heating, formation of sulphocyanides at the expense of the ferrocyanides is itself very considerable, and Dr. Burschell estimates that it may attain as much as 30 per cent. of the ferrocyanides. This transformation is due to the action of the ammonia and sulphuretted hydrogen contained in the materials, favoured by their moisture; also to the action of sulphur and alkaline sulphides on the ferrocyanides.

As can be well understood from this rapid glance at the complex reactions which accompany the formation of the cyanogen compounds, both in the gas itself and in the ammoniacal liquor and purifying materials, their production is closely connected with many conditions which the gas manufacturer desirous of recovering the cyanogen should endeavour to avoid or to bring about, according as they are or are not favourable for so doing.

AIR-SUPPLYING APPARATUS FOR CONTINUOUS REVIVIFICATION.

An apparatus has recently been described by Herr D. Pflücke in the "Journal für Gasbeleuchtung" which aims at effecting a regulated admixture of air with the coal gas as made, with the object of bringing about continuous revivification of the oxide in the purifiers. It has been in use at Kötzschenbroda since November last year, and possesses certain features which seem to merit attention.

There is an air-pump, which is connected with the axle of the gas-exhauster, so that the pumping of the air is regulated according to the make of gas. But there are further provided means for regulating the pressure at which the air is pumped, so that more exact regulation of the relative proportions of air and gas may be secured. These means consist of the apparatus illustrated in fig. 1, in which the air from the pump enters the bell A, and has to pass through the valve shown in order to reach the chamber E. This valve is so weighted that it remains at rest in any position, but is automatically altered when the bell moves, in correspondence with the pumping, over a greater range than the play of the crank admits of. The alteration of the height of the bell thus governs the size of the outlet into the chamber E, of which again the outlet is controlled by another valve, which is connected with the bell B. The fluctuations of pressure due to the pump will thus have been taken up by the bell A; while the bell B is weighted to give the desired pressure at the outlet from E.

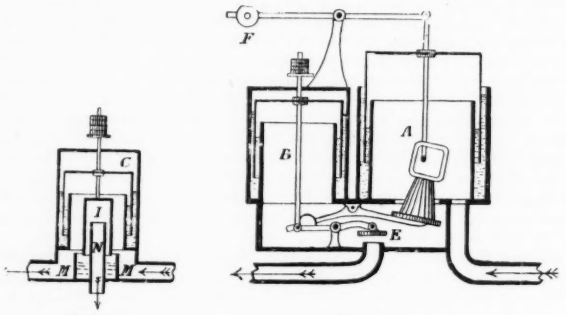


Fig. 1.

Fig. 2.

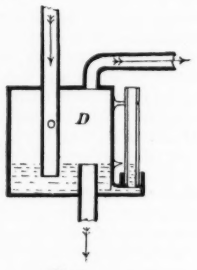


Fig. 3.

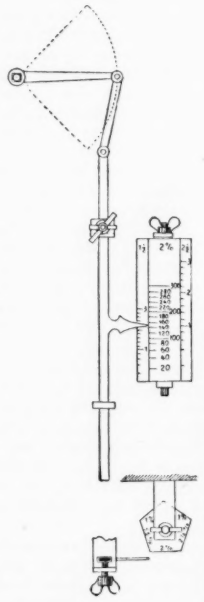


Fig. 4.

The air passes from the outlet to the governor C (fig. 2), which affords a vent through the dip-pipe I, the mercury seal M, and vent-pipe N, for surplus air when the pressure raises the weighted bell, and therewith the attached dip-pipe I. From the governor, the air passes to the regulating chamber, where a special apparatus (shown in fig. 4) admits of the exact proportion of air desired being maintained. This apparatus comprises a regulating tap, connected to a moveable pointer, and a scale having five divisions. The graduations on the scale are made by dividing the number of litres passing in six minutes by the percentage. It is then only necessary to set the pointer opposite the figure representing the make of gas (in cubic metres) per hour, and the air supply follows in the desired percentage.

The air passes from this regulating apparatus to the seal-pot D (fig. 3), with water-level gauge. This seal-pot is intended to prevent tar and liquor passing back when the exhauster is not at work. From the seal-pot the air passes into the hydraulic main of the coal gas plant. The bells of the apparatus are weighted so as to give the requisite quantity of air according to the pressure. The weight F (fig. 1) is moved back until fluctuations can no longer be observed.

Similar apparatus has been in use for four years, at the Kötzschenbroda Gas-Works, for getting rid of the fluctuations of the exhauster, and also in connection with consumers' gas-engine

installations in the town. It has proved a success in both these applications. The apparatus is said to require but little management, and that such as the ordinary staff are readily able to exercise. The arrangement for setting the proportion of air is really all that needs attention, and this only when the proportion has to be altered. Greatly improved working is said to result from the adoption of the apparatus. It will be observed that the practice at Kötzschenbroda has been to add the air to the gas in the hydraulic main, instead of at a later stage.

A CLIP FOR GAS-METER CONNECTIONS.

Some extraordinary results have been secured by the Liverpool Gas Company, by the fixing of a recently-invented pipe-union clip to their meter connections, in cases where the smallness of the consumption shown by the meter could not be accounted for. In eight instances, the value of the gas registered in one quarter, without the use of the clip, totalled to £2 4s. 11d.; while in a similar quarter, after the clip had been attached, gas to the value of £6 3s. 11d. was indicated by the same meters—showing an increase of about 180 per cent. Under these circumstances, it is no wonder that the Company resolved to fit the clips to all their 3-light and automatic meters, as fast as a supply could be secured. The clips completely cover the unions of the meter connection, so that it is impossible for the latter to be unscrewed; and the appliance is secured in position by filling the cup or well with which it is provided with wax or other suitable substance, which is afterwards stamped with the seal of the gas undertaking. The object of the contrivance is, of course, to put a stop to the far too common practice of stealing gas by means of unscrewing the meter-unions and connecting the inlet and outlet pipes by means of tubes. Where this clip is employed the pipes cannot be tampered with in any way without the fact being discovered by the inspector on his next round, for the seal would be found broken. It will be remembered that the Coroner's Jury who inquired into the recent gas poisoning fatality at Heywood recommended that disconnected service-pipes should be sealed in some way, so as to prevent them being brought into use again without the knowledge of the officials; and we would suggest the possibility of introducing some modification of the present appliance which could be utilized for this purpose by gas supplying authorities who so desired. As has often been remarked before, the tampering with gas-fittings by inexperienced persons is an exceedingly dangerous, as well as a dishonest, action; and anything that can be devised in order to prevent it is therefore to be doubly commended. The invention to which we now call our readers' attention is the patent of Mr. G. W. Briddon; and the right to manufacture and sell the arrangement has since been acquired by the Pipe Union Clip Company, of Holmes Chapel, near Crewe. The clips are very cheap; and gas managers can perform a simple and interesting experiment by obtaining a quantity and instructing the inspector, while on his usual rounds, to fix them to all meters which appear to be registering an abnormally small consumption of gas.

Mr. W. J. Dibdin on Public Lighting.—We have received from the Sanitary Publishing Company, Limited, Mr. W. J. Dibdin's recent volume entitled "Public Lighting by Gas and Electricity," the scheme of which, he tells us in his preface, has been the collection of a series of representative facts relating to the production and utilization of light for public use. The book consists of 528 pages of letterpress, fully illustrated; and there are several large sheets of tabulated particulars, followed by an index. We purpose reviewing the work next week.

Trade Unionism in England and America.—The remarks which we have so frequently felt it our duty to make with regard to the present Trade Union policy in England evidently apply with equal force to the condition of affairs on the other side of the Atlantic; for the Engineer of an important Gas Company in the United States writes as follows: "Allow me to say that I am especially informed and pleased with your clear unbiassed information and comments on Trade Unionism as it operates in Great Britain; and I might say that we in America are following in your lead, and with the same tendencies—decreased production per unit of labour and increasing conflicts between employers and employees. If it continues, Great Britain and America will surely fail in the near future to maintain the industrial lead we now have."

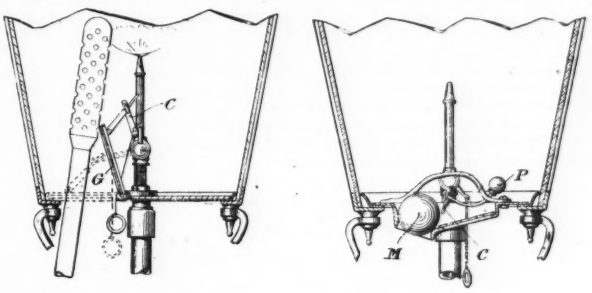
Future of the Gas-Engine.—In the opinion of Professor Thurston, the gas-engine is a formidable rival of the steam-engine, and is capable of further development. Each has given a horse-power for about 1 lb. of coal; and the efficiency of both, between the coal pile and the point of delivery, is about 20 per cent. The steam-engine, he says, has so nearly reached its limit that further progress under commercial conditions would seem to be very slow; but its range may be increased by employing very high pressures and superheating combined with them. In Sibley College work, 1000 lbs. per square inch have been used; and Professor Thurston expresses the view that twice this pressure may be successfully used eventually, or with sufficient experience in its management. These factors would raise the efficiencies nearly 50 per cent., and reduce the coal per horse-power-hour to about ¾ lb.

REGISTER OF PATENTS.

Lamps and Lanterns.—Tilley, F. C., of Kingsland Road, E. No. 75; Jan. 1, 1902.

This invention relates to lamps or lanterns provided with a flap through which a torch is passed to ignite the gas; the object being to arrange that, on the flap being opened by the torch, the gas is turned on ready to be ignited by the torch on its arrival at the burner—the closing of the flap due to the withdrawal of the torch not actuating the tap to cut off the gas supply, which is effected by actuating the burner-plug by a separate appliance.

Illustrations are given of two forms—one in which the plug-operating rod is connected to the door, and the second where, instead of a door being employed, a sphere closes the opening and also actuates the plug-operating rod when moved by the torch.



The plug of the gas-tap is provided with a pin or a ratchet, lug, or other appliance to connect it with a lever C; this having a lug, pawl, or other projection D, so that it can actuate the plug in one direction only, and be allowed to return in the reverse direction without actuating the plug. The lever C, according to the first arrangement, is pivoted or swiveled to a rod which is hinged to the flap G; so that on the flap being pushed open by the torch, the lever C will be actuated, and this in turn will turn the plug to open the gas supply to the burner for the gas to be lighted on the insertion of the torch into the lamp. The torch being withdrawn, the flap will close and bring back the lever C to its original position, but without closing the plug; this being effected by other means—such as by a pull on a chain connected to a separate lever fixed to the plug.

According to the second arrangement, the appliances are so constructed as to be actuated by a ball M, which in its normal condition closes the inlet for the torch. In this case, the lever C is provided with an arm carrying a weight P so as to ensure its return after the ball is released. In action, the head of the torch (on being inserted into the lamp) displaces the ball and causes it to ride up an inclined track, and in so doing act against the lever C and move the burner-plug; the torch, riding against the ball, keeping it in position while being inserted and withdrawn from the lamp. But so soon as the torch is removed from the lamp, the ball falls and closes the opening; and at the same time the weight P brings back the lever C without operating the gas-tap as in the previous figures.

Internal Combustion Engines.—Thwaite, B. H., of Westminster No. 108; Jan. 2, 1902.

In the operation of an internal combustion engine on the "Otto" cycle, there is (the patentee points out) only one effective or power developing stroke in every four; three of the strokes are actually power or energy absorbing ones. For instance, there is, first, the expulsion of the residual gases; secondly, the aspiration into the cylinder of an explosive gaseous mixture; and, thirdly, the high compression of the gaseous mixture. All these operations absorb power in some measure; the result being that the cyclical or rotary movement of the crank-shaft cannot be uniform, because the fourth operation is the only positive or dynamic power developing one. Therefore the fly-wheel, or the driving pulley transmitting the power, does not run with sufficient uniformity to satisfy the exigencies required for the production of electric energy, and especially when the elecric generators are of the polyphase type. To overcome this turning irregularity, the following expedient, which constitutes the main part of this invention, is suggested.

In addition to the ordinary fly-wheel (or fly-wheels) rigidly attached to the crank-shaft, there is another fly-wheel that can run in one, or the forward direction quite freely round the crank-shaft. The rigidly attached fly-wheel or fly-wheels are of sufficient peripheral weight to permit the "Otto" cycle—of one effective power developing stroke and three non-effective strokes—to be performed, however low in thermal value the gas may be. When the explosion or ignition of the combustible charge takes place, the crank-shaft drives round the free fly-wheel; but at the end of the effective stroke—owing to the absorbtion of the energy in completing the "Otto" cycle, and when the full power of the engine is accumulated as potential energy in the periphery of the free fly-wheel—the latter may revolve at a greater velocity than the crank-shaft, because the free wheel that transmits the power is dragged, retarded, or braked, only by the effect of the output load, whereas the crank-shaft and its fixed fly-wheel have to complete the three power-absorbing strokes, and this work includes the compression of the explosive mixture and the provision of the power absorbed by the engine by its own motion. A suitable form of clutch, or pawl and ratchet (mechanically devised so as to be noiseless, and be as near frictionless as possible), is employed, so that when the explosion takes place, the crank-shaft motion is so accelerated that the clutch comes into play and forces forward the free wheel, but falls out of interference when the crank-shaft speed is checked.

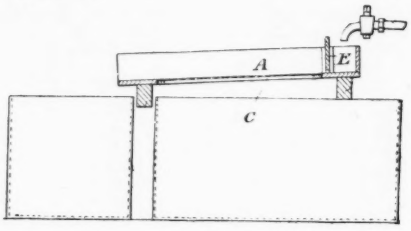
In order to avoid the hammering effect on the crank-pin—the resu

of the maximum power development taking place when the crank is at its dead-centre—the patentee proposes to lower the centre of the crank-shaft to a little below the level of the centre-line of the cylinder. When the engine is a vertically acting one, the vertical centre-line of cylinder and crank-shaft are preferably arranged so as not to exactly correspond.

Separating Solid Matter from Tar.—Davies, P., and the Hydroleum Company, of High Holborn. No. 484; Jan. 7, 1902.

The above-named Company's inventions have been referred to in the "JOURNAL" from time to time. The present one consists of a process for the separation of undesirable matter from carburetted water-gas or analogous tars, by subjecting the tar, either before it enters the separator or after it has passed such separator, or both before and after it has passed the separator, but in all cases before it is subjected to any pumping process, to the action of mechanical separation.

The patentees remark that various tars—especially carburetted water-gas or oil-gas tar—contain in suspension water, lamp-black or carbon, fuel-ash, and other matter of an undesirable nature when the tar is required for liquid-fuel purposes. The tar is now first conveyed to a "separator," where it parts with a considerable quantity of its water; but all foreign matter remains in it. Thence, in existing methods, the tar, still containing foreign matters, is pumped into a reservoir. This pumping process, however, so churns together the tar with the remaining water and the foreign matter, that it is afterwards impracticable to mechanically separate them.



A method which is found to be effective consists in allowing the tar to run over one or more sieves of suitable mesh disposed at a suitable inclination—the good tar passing through the sieve or sieves, and the waste running over the end, as shown in the illustration. A is a sieve constituted by an inclined trough or channel-way. The lower end is open. Its other end and sides are made of wood or other material; while the bottom is formed by wire gauze-cloth C. The flow of tar is regulated by a slide or sluice E, which is so adjusted as to cause the tar to issue past it in a film or thin layer. Receptacles below the sieve collect the good tar and waste, which issue respectively through the sieve and at its end.

The inclination of the sieve and the mesh of the gauze-cloth may be varied according to requirements; but an inclination of 3 inches in a length of 6 feet, and a mesh of from 50 by 50 to 60 by 60 are said to give good results when dealing with carburetted water-gas tar of average character.

Retort-Charging Apparatus.—Wise, W. L.; a communication from the Compagnie Parisienne d'Eclairage et de Chauffage par le Gaz. No. 791; Jan. 10, 1902.

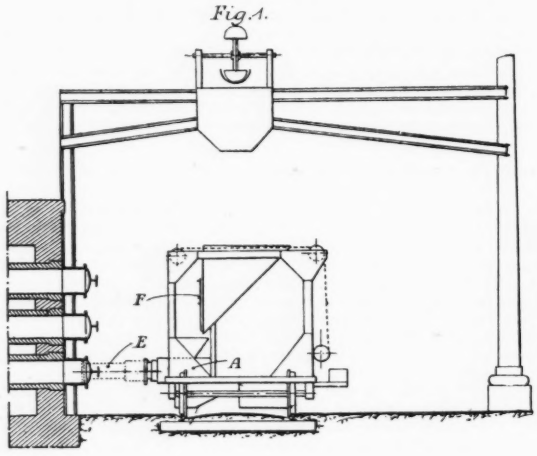
Apparatus according to this invention for charging gas-retorts is so constructed that it enables the quantity of coal required for charging a retort to be distributed throughout the entire length of the retort and to the height determined upon, by allowing the coal to fall into a rotary device (the speed of which can be varied), which projects the coal by centrifugal force. For varying the speed, the patentees prefer an electric motor whose speed—which is at a maximum at the commencement of the operation, in order to project the coal to the back of the retort—can be reduced by the automatic introduction of resistances so as to diminish the speed of rotation of the blade or blades of the rotary device, and gradually bring it to the speed required to cause the last pieces of coal of the charge to be deposited at the front of the retort, no matter what be the weight and quality of the coal and the length of the retort.

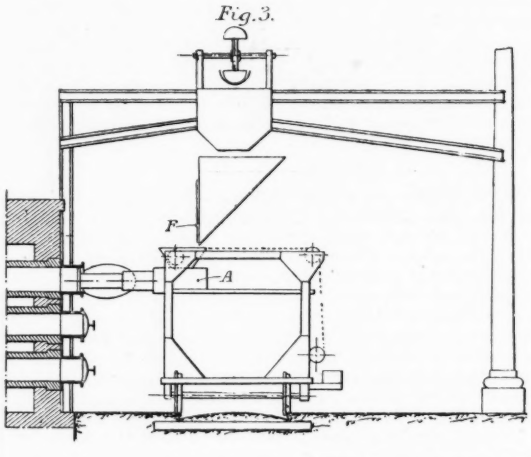
Fig. 1 is an elevation of the apparatus in use with retorts arranged in three tiers. Fig. 2 is a plan. Fig. 3 is an elevation showing the apparatus applied to the charging of the upmost row of retorts. Figs. 4 and 5 are a plan and vertical section showing the device for projecting the coal into a retort.

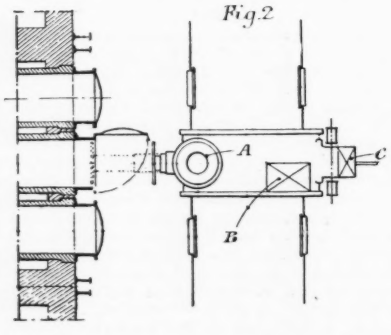
The coal is supplied in any suitable automatic manner to a hopper adapted to contain the charge for one retort. The hopper feeds a rotary projecting device A, which is operated by an electric motor controlled by a rheostat. The hopper, the projecting device, the motor, and the rheostat are mounted on wheels to run on rails, and provided with means for raising and lowering the projecting device, the hopper, and the motor to suit retorts at different levels. The dynamo is shown diagrammatically at B. The complete rheostat is shown at C.

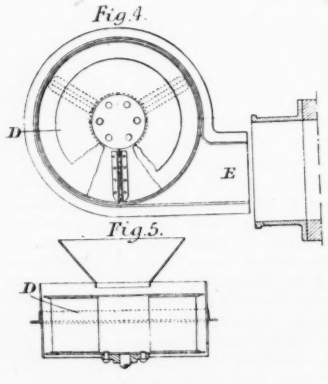
The coal projecting device A comprises a disc furnished with blades or vanes D, and driven by the motor at varying speed, so as to project the coal by centrifugal force through a nozzle E leading to the retort. The speed regulator is arranged to come into action at the moment when the door F of the hopper is opened. It interposes into the circuit of the motor increasing resistances, which regularly reduce the speed of the motor, and, consequently, also that of the charging apparatus.

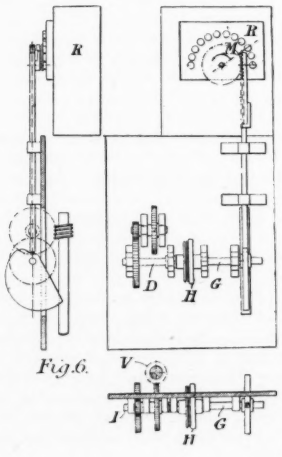
The speed regulator (fig. 6) comprises a rheostat R, whose lever M is fixed to a toothed wheel that engages with a vertical rack arranged to be moved by a cam fixed to one end of a shaft G that carries at its other end a friction disc H. Opposite to the friction disc another friction disc is keyed on the end of a shaft which is co-axial with the cam-shaft G, and is driven from the shaft of the electric motor by means of a train











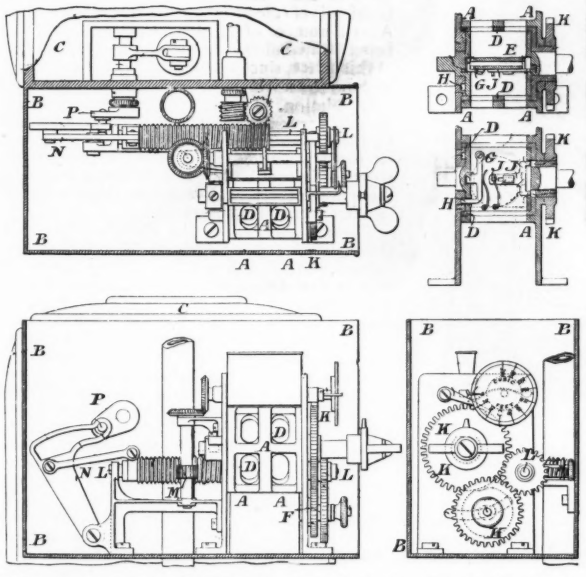
of toothed wheels and a worm V. By means of a spring at the end of the cam-shaft G, it is possible, at a given moment, to exert pressure on its end, so as to bring it closer to the shaft I, and thereby to bring the friction-disc H into contact with the friction-disc, so that the cam-shaft G will be rotated.

The apparatus acts in the following manner : When the door of the coal-hopper commences to open, the spring at the end of the shaft G is automatically put in stress. The shaft is thus moved towards the other shaft I, and the two friction discs bear against each other, so that the cam is rotated, and the rack whose lower end bears upon the cam is raised. The rack, in rising, moves the wheel in engagement therewith, and therefore moves forward the lever M of the rheostat; so that its contact-piece passes in succession over the several fixed contact pieces, and gradually reduces the speed of the motor that drives the charging apparatus.

Coin-Prepayment Mechanism for Fluid Meters.—Grieve, G. K., and Peebles, W. Carmichael, of Edinburgh. No. 2615; Feb. 1, 1902.

This invention—"to improve and simplify the construction and action of coin-prepayment mechanism for fluid meters"—is shown in plan, side elevation, and end elevation; also some details connected with the mechanism.

A cylindrical chamber A is mounted horizontally in an outer casing B connected to the meter-case C; the chamber having coin slots formed in its upper and under sides. Within the chamber A, there works loosely a cylindrical box D, also having similar slots formed through it at diametrically opposite points. A flat pocket E for the reception of coins is fitted to turn loosely in the inner box D, and also to turn with the box; the pocket and box being connected for this latter purpose in the following way: A small coin-gripping lever G is hinged at one end on the side of the pocket E; the lever being formed with two finger parts—one at the central part of the lever projecting into the pocket, so as to grip or bear on the edge of the coin inserted, and the other at the end of the lever, being arranged to bear on a face cam H, formed on a circular track on the inner side of the cylindrical chamber A—a controlling blade spring being fitted to the pocket so as to act on the back of the lever. On the same side of the pocket, but opposite the central part of the lever G, there is fitted to slide on a fixed guide or stop-pin, a bolt J, also controlled by a similar blade spring fitted to the pocket. On the outer end of the bolt, there is formed a finger part, which projects into the pocket at the side, so as to bear against the opposite edge of the coin. A cross-head, furnished with toes, is also formed on the same end of the bolt; the toes being arranged to slide into slots or sockets formed in the side of the box D, thereby connecting the pocket to the box as required. The coin-pocket is provided with end spindles, the latter spindle of which is fitted with a handle. A tappet is fixed to the spindle, and is arranged to act on stops on the side of the bracket, so as thereby to limit the turning movement of the pocket to a half-turn in both directions. The box D is provided at one end with a hollow spindle or journal part,



which works on the end spindle of the pocket. The hollow spindle has fixed to it a spur-wheel K, which gears with a pinion mounted on a sleeve F, which runs loose on an intermediate spindle mounted in a quadrant slot formed in the framing; a pawl stop being fitted to engage with the spur-wheel, so as to prevent it turning backwards. The sleeve F, carrying the wheel, has also fixed to it a change-pinion, which gears with a pinion fixed to a spindle L, mounted horizontally on the framing; the spindle being fitted with a sleeve arranged to slide on, and turn with, the spindle by means of a feather and groove or other equivalent connection. One end of the sleeve is formed with an external threaded screw, which engages with a worm-wheel turning on a stud mounted vertically on a bracket fixed to the meter-case C, and gearing with a worm worked from the ordinary meter mechanism. The other end of the sleeve is in the form preferably of a rack or screw, which gears with a pinion M fixed to a vertical spindle connected, through bevel gear, with a horizontal spindle carrying a dial arranged to work behind a fixed pointer, so as to indicate the fluid paid for and not yet consumed. A rod N is connected to the rack end of the sleeve and to a lever turning on a pin fitted to the framing; the lever being formed with a cam slot at its outer end. A short lever P is fixed to a horizontal shaft, having on it a lever connected to the spindle of the admission-valve; a pin on the short lever being fitted to work in the cam slot of the cam lever piece.

The parts are shown in their starting positions, with the slot openings in the chamber A, box D, and pocket E, opposite each other on the top and bottom; the pocket opening being immediately under a hopper provided for guiding the coins into the pocket. When a coin is inserted through the hopper into the pocket E, and the handle lightly turned clock wise, the face cam H, on the inner side of the chamber A, forces in the hinged or coin-gripping lever G, which then pushes the coin to the other side of the pocket, and causes it to force out the toes of the sliding-bolt J into the sockets of the inner box D; thereby making a positive connection between the pocket and the box, so that the two will turn together. When the pocket and box have been turned half round, the coin-gripping lever returns to its starting position by the action of the controlling spring; the face cam H being shaped so as to permit this return movement of the lever. The sliding-bolt J likewise returns to its normal or starting position by the action of its controlling spring; and as the positions of the slot openings in the pocket E and box D are now exactly reversed, the coin falls into a receptacle (not shown) arranged underneath the chamber A. The coin-pocket E can be turned back to enable the action to be repeated as many times as that for which the mechanism is constructed; a stop-pawl preventing any backward movement of the inner box D. The continued forward turning of the box, as described, turns the spindle L, and causes the sleeve to travel forward on the spindle. This movement actuates the cam-lever; and the cam-slot then acts on the short lever P, so as to raise or open the admission valve as required.

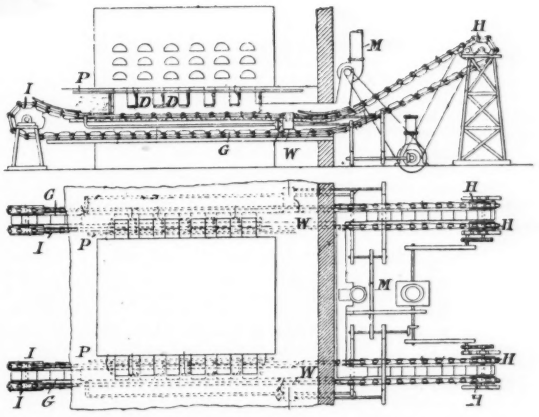
The inner or shorter portion of the cam-slot is shaped so as to fully open the admission valve on the first slight rotation of the inner box D; the longer portion of the cam-slot being shaped so as to keep the valve in this full open position during the further rotative movement of the inner box. The forward movement of the sleeve at the same time causes the rack to work the dial, and thus indicate the amount of gas paid for and to be consumed. When either the full or any lesser number of coins has been inserted and the meter is delivering fluid, the ordinary meter mechanism, acting through the worm, rotates the worm-wheel engaging with the screwed part of the sleeve, so that the sleeve is moved back to its starting position. This reversal of the sleeve reverses the action of the gear connected to the admission valve and indicating dial, so that the valve closes and the dial rotates backwards till it again assumes its starting position.

Conveyors for Retort-Stacks.—Bronder, G. A., of New York. No. 12,084; May 27, 1902.

The construction and working of this plant will be clearly appreciated from the accompanying illustrations and the following description. The patentee's object is to provide means to carry away the hot coke, quench and spray same with water, and prevent the escape of smoke and gases into the retort-house by "efficiently expelling them to the outside of the stack-house as quickly as generated, and discharging any coke breeze which may be separated from the coke, as well as the coke."

Fig. 1 is an elevation of the plant. Fig. 2 is a plan, with a horizontal section through the wall of the house. Fig. 3 shows a partial section (on an enlarged scale) of fig. 2. Fig. 4 (p. 40) represents a partial section of fig. 3. Fig. 5 is a section of fig. 3. Fig. 6 shows a plan of a collecting chamber. Fig. 7 represents an enlarged section of the lower "runway track" and appurtenances.

Fig. 1.



The floor of the retort-house constitutes a platform extending beyond the walls, with shoots D arranged below the floor level leading to troughs below with buckets G, over which are supported the flues. The top surfaces of the troughs constitute tracks for the wheels of the conveyors. The chains of the conveyors are driven by sprocket drive-wheels H, and turn over the idler wheels I; the lower or secondary line of conveyors running on runway tracks. Guides are placed near the idler wheels to lead the conveyors into the conduits; and the other guides near the ends of the troughs and directly over depressions in them, deflect the conveyor buckets below the level of the main horizontal runs of the conveyors—"thereby securing the effective submerging of the contents of the conveyors."

The flues are connected with an exhaust blower or apparatus M, by means of piping; the flues extending at the ends so as to closely approach the bodies of the conveyors and prevent leakage. Water-pipes P, having outlets with spray heads, are secured under the floor,

to direct streams of water into the conveyors and troughs. At openings through the bottoms of the troughs, there are fastened collecting chambers W, and from the latter extend secondary chambers that lead to a third set of chambers, which encase the propellers. Piping extends from the third set of chambers to other portions of the troughs—constituting bye-passes for the troughs of the conveyors; and the propellers may be employed to force water through these bye-passes, or steam-injectors may be used.

A secondary conveyor Z operates in the collecting chamber W; and its blades move on, or in close proximity to, an inner surface of the chamber. A driving wheel and idler sustain and guide the conveyor Z, which is propelled by means of the shaft shown. The sides of the collecting chamber W are extended above the water-line V in the trough; and the latter consists of the bottom plate with the sides, on top of which the running gear or wheels of the conveyor run.

At the lower portion of fig. 3, a bucket is shown in its inverted position on its runway tracks supported on ties, by forming, in the ends of the ties, hooks, and bevelled ends; the tracks being forced under the hooks by washers which bear against the flange of the track by means of bolts.

The shoots D comprise two fixed sides and a moveable or swinging side, which latter can be tilted on pivots so as to form a diverting shoot, as shown by the dotted lines in fig. 3. By means of the moveable sides, the respective shoots can be closed, and the coke can slide down the tilted sides in the ordinary way—allowing repairs and adjustments to be made to the conveyors. The conveyors consist of the buckets G, the bottoms of which extend upwardly beyond the sides and are connected with the linked drive-chains.

Fig. 3.

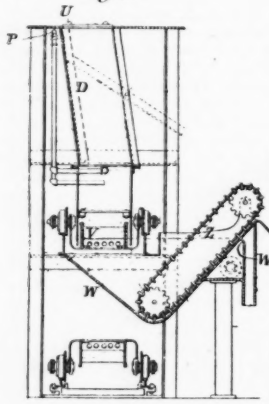


Fig. 4.

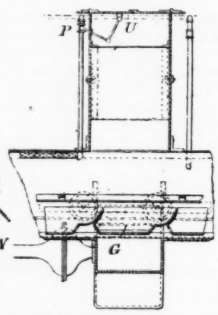


Fig. 7.

Fig. 5.

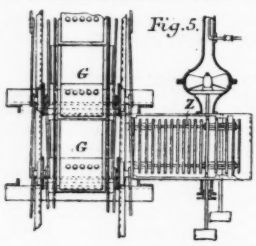
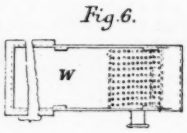


Fig. 6.



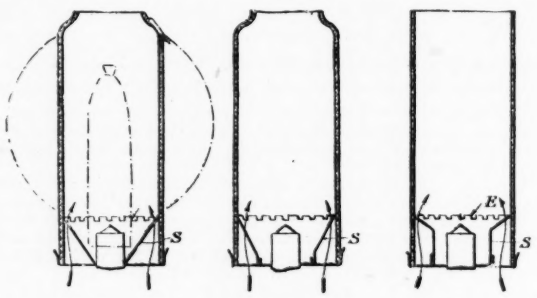
To propel the conveyors, an engine (by belting or equivalent means) drives the wheels H of the linked drive-chains, and the respective pulleys of the blower M and of the secondary conveyors Z. The covers U are opened to allow the hot coke to be discharged from the mouthpieces, and fall into the buckets of the conveyor; and with the same operation the water-valves are opened, thereby quenching the charges and spraying them as they pass under the water-outlets. The trough, as previously mentioned, is filled with water to the level V, thereby sealing the lower sides of the flues and preventing any dust, smoke, or other gases from escaping except by way of the blower apparatus, which also creates a suction inwardly in the shoots and prevents the dust, &c., rising.

When the conveyor, with its buckets G, is travelling in its flue, and it is used for conveying and quenching coke, the breeze deposited on the bottom of the trough will be carried to the collecting chamber W, where it is taken by the conveyor Z and deposited on the outside over the apron; while the perforations in the side of the chamber allow the water to run through (constituting a strainer), and the conveyor blades operating over the holes keep them clean. The propeller wheel or steam injector takes the water from the secondary chamber connected with the collecting chamber W, and forces it to the other end of the trough. Consequently, it maintains the water at a uniform height in the trough and flue—avoiding friction between the conveyor and the water by circulating the water at the same speed as the conveyor.

Burner for Incandescent Gas Lighting.—La Société Houdaille et Triquet, of Paris. No. 18,590; Aug. 23, 1902. Date claimed under International Convention, Feb. 18, 1902.

In incandescent gas-burners, it is of advantage to bring as much of the combustible gaseous mixture as possible into contact with the surface of the mantle; and the present invention is designed with the object of generating or quickening the flame, and of bringing about the realization of this desideratum.

The invention consists essentially of a burner provided with a special gallery, which can, according to the arrangement adopted, have one or two rows of retaining claws. In the first of the three arrangements shown, the gallery has a single row of retaining claws, against which is placed the chimney (of any description). Arranged in such a manner as to rest with approximate exactness against the interior surface of the chimney, is a deflector or guide-piece S, having the form of a hollow truncated cone, the expanding portion of which is disposed upwardly. The upper edge is notched, indented, or serrated, so that the air coming from the gallery, enters the chimney in the form of jets—"generating the combustible mixture and giving the desired result from the point of view of light." In using this arrangement, it may be found, say the patentees, that the piece S interferes with the adjustment of the rod which carries the mantle, and that the flame generated by the jets of air impinges against the chimney and blackens it or causes it to break.

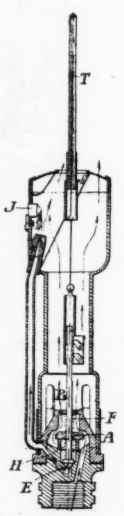


In the second arrangement, which is free from the objections just above referred to, the gallery has two concentric rows of claws. The piece S is supported on the exterior of the inner row of claws, and rests against the interior surface of the chimney. The air necessary for the generation of the flame penetrates into the burner through perforations in the base-plate between the two rows of claws; the portion of the base-plate in the centre of the piece S being unperforated.

The third is a simple modification of the shape of the piece S; it being arranged in the interior of the inner row of claws. Its sides are approximately vertical or slightly inclined, and splayed at their upper part, so that, as before, the upper edges bear against the interior surface of the chimney.

Lighting Gas-Burners Automatically and from a Distance.—Canellopoulos, J. M., of Paris. No. 17,791; Aug. 13, 1902.

The patentee remarks that the various appliances hitherto employed for automatically lighting incandescent burners have not given very satisfactory results, primarily consequent on the faulty means for communicating the small flame kindled by the igniting body to the main burner—presuming that the ignition is effected from the outside of the mantle. After a number of ignitions, the mantle, through being heated always at the some point, stretches at this place, since it is brought to incandescence without the rest of the fabric being submitted to the same dilation. Little by little the mantle breaks at this particular point, and is quickly followed by the breaking of the glass, which, often falling on the mantle and the igniting apparatus, destroys or injures both. It is in order to remedy these (and other) inconveniences that the following arrangement is suggested.



The gas passes into the chamber containing the valves A and E; and as the rod T is contracted, the valve A will be held up against its seat, so that the gas will enter the passage belonging to the valve E and reach the igniting body J. There it is ignited, and the flame will heat the rod T, which will expand and allow the valve E to drop upon its seat and close the passage for the gas passing to the igniting pastille. Simultaneously the valve A will descend, and allow the gas to pass to the main burner, which will then light in the usual way. When it is lighted, the metal rod T will remain expanded, and, consequently, the valve A will remain open. But when the gas is turned off, the rod cools and contracts thus closing the valve A and leaving the valve E open, by the operation of the spring F. By means of the special arrangement shown at the end of the metal rod B—a sliding double pawl—if any elongation is produced, this will have no effect on the working of the burner, as the end of the metal rod will descend one thread of the screw, but the pawl will prevent it from rising again without simultaneously actuating the valve E.

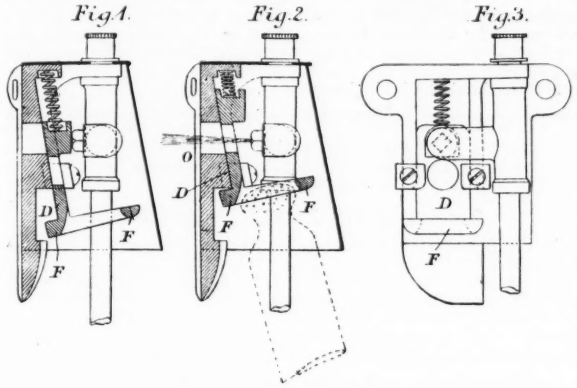
The spring H of the valve A is intended to close the valve; for it is difficult to adjust a burner to any absolute length, seeing that burners are used in places where the temperatures vary. Moreover, the expansion and contraction of the metal rod T are not always the same. In this way, a very satisfactory result is said to be obtained, seeing that, when the valve is closed, if the metal rod T has any tendency to contract, it can do so freely, because the rod of the valve can rise without the valve being carried up with it.

Igniting Gas-Lamps.—Haddan, H. J.; a communication from the Compagnie Belge pour la Fabrication des Compteurs et Materiel Gaz, Eau, Electricité, of Brussels. No. 21,389; Oct. 1, 1902.

This invention refers to igniting apparatus for gas-lamps in which a jet of gas is directed from outside the lamp into the interior above the chimney of the principal burner; and it consists in arranging the

controlling device in front of the gas-outlet aperture of the igniting-burner and connecting it to the abutment for the igniting-torch.

The controlling arrangement is in the form of a slide comprising the actual closing or controlling device, and also the abutment for the igniting-lamp. The slide is held in position by gravity (preferably with the aid of a spring), and is adapted to move in an inclined plane so that its movement takes place in the natural direction of movement of the torch, but more particularly for the purpose of effecting a complete and efficient closing of the burner hole. It is also adapted to automatically take up the wear of the surfaces of the slide and the tubing of the igniting-burner.

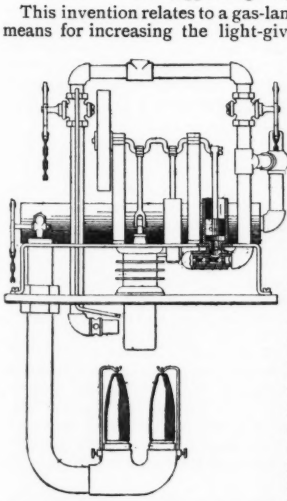


One form of the apparatus is given. Fig. 1 shows the closing or controlling device in the resting position; fig. 2, in the igniting position, at the moment when the torch has been introduced; and fig. 3, a rear view of the apparatus with the bell or hood removed. In front of the igniting-burner is a slide D with a head of conical section, which forms the closing or controlling device, and an annular foot F which forms the abutment for the igniting-torch. The slide bears on an inclined surface, against which it is held by lugs, and guided in such a manner as to move obliquely with regard to the burner; the closing head being moved away from the burner during the upward movement of the slide, and approaching the burner again during the downward movement thereof. The slide is moved upwards by the pressure of the igniting-torch, and descends again by gravity when the torch is removed. This descent is preferably assisted by a spring placed above the slide.

Opposite the nozzle an aperture O is provided, through which the jet of ignited gas can pass into the lamp. The controlling device also has the advantage of closing this aperture when in the position of rest. The slide is provided with an aperture which coincides with the aperture O when the apparatus is in the igniting position. The bell or hood is adapted to be screwed to the gas-pipe. At the moment of igniting, the torch, introduced in a more or less inclined position, pushes the slide upwards, so that the aperture in it is moved opposite the aperture O, and the gas is ignited by contact with the flame of the torch, and passes in the form of a jet through the apertures into the interior of the lamp, where it ignites the lamp-burner. When the torch is withdrawn, the slide descends to its original position.

High-Power Incandescent Gas-Lamp.—Boult, A. J.; a communication from the New Process Lighting Company, of Cleveland, Ohio, U.S.A. No. 18,133; Aug. 18, 1902.

This invention relates to a gas-lamp "with self-contained and efficient means for increasing the light-giving power of its burner." This is accomplished by providing a caloric engine driven by the heat from the burner; the mechanical energy of the engine being used to compress the gas supply into a reservoir, from which it is allowed to escape in a jet to the burner, taking with it an augmented supply of air.



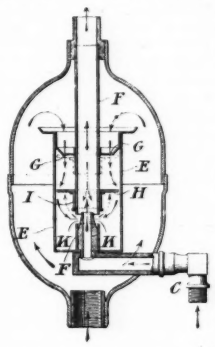
The term "caloric engine" is used (say the inventors) in contradistinction to any apparatus driven by the shaft generated by the heat of the lamp, or any arrangement for mechanically separating heated gas from cooler gas, relying on the tendency of the hotter gas to expand to give it pressure, "for such arrangements do not possess sufficient power to produce the operation desired." The caloric engine in the present invention is supported so that it is driven by the waste heat from the burner, and converts that heat into rotary mechanical power, compressing the gas by a suitable pump into a reservoir, whence it escapes in a jet into a pipe having an external opening through which air is drawn by the force of the jet—the pipe conveying the gas and air to the mantle.

As shown, there is provided a heat-insulating diaphragm above the burner, and supporting the bed-plate of the caloric engine of any known type. The contraction and expansion cylinder of the engine extends partly below the diaphragm so as to expose the lower or expanding portion to the heat from the burner.

When in operation, the heat from the burner causes the motor to rotate the crank-shaft which drives the pump to compress gas into the reservoir. The gas under pressure discharges into the burner-tube in the form of a jet, and thus it draws through the tube the proper quantity of air to cause the gas to burn "with the best results." To cause the motor to operate sufficiently to properly compress the gas before the regular burner is ignited, a branch-pipe leads from the main gas-pipe, and is provided with a burner adjacent to the expanding cylinder of the motor. A continuously burning pilot flame serves to ignite the gas issuing from the main burner when the valve is opened. The gas to the pump being turned on, and the supply to the heating burner being also turned on, the cylinder of the motor is heated so as to cause it to operate to charge up the reservoir. After this the heating burner is dispensed with; and then the compressed gas is admitted to the burner-tube as desired. This gas, rushing in, draws air around it—constituting the burner a bunsen burner, which "gives an intense heat and a correspondingly intense light to the mantles."

Mixing Air and Gas for Incandescent Lighting Purposes—Tresenreuter, G., of Berlin. No. 18,310; Aug. 20, 1902.

Numerous attempts have been lately made, says the patentee, to produce a mixture of gas and compressed air for burning, for the purpose of increasing the illuminating power of the light obtained. When such a mixture is used for lighting the interior of buildings, there is, however, a drawback, in that the compressed air admitted to the gas just before the flame is formed causes a considerable noise. The object of this invention is to construct apparatus to obviate this drawback. It consists of a mixing vessel or bell introduced into the gas-pipe at any desired point—say just behind the meter—so that the mixture passes already through the remainder of the pipe to the burner.



The compressed air is admitted through a pipe C terminating in a nozzle, on which is placed a drum E. Through the drum passes a central tube F, provided with slots K, and connected again to the gas-pipe A. The cover of the drum is furnished with openings G, and has in its interior a leather disc-valve H, held in a central position by a guide.

The manner of working of the apparatus is as follows: The gas entering the vessel at A, fills it, and passes through the openings G into the drum E, whence it is carried away by the compressed air. The gas becomes thoroughly mixed with the air, and flows again into the gas-pipe through the tube F. The compressed air enters through the pipe C; thence through the nozzle and past the slots K, and in its passage draws in the gas in the same way as an injector.

In order to prevent the compressed air from entering into the portion of the gas-pipe situated in front of the mixing device when the gas-pipe behind the device is closed, there is provided the valve H. When the gas-pipe is closed, the air cannot escape at the top through the pipe E and, being under pressure, enters, through the slots K, the drum F, under the valve H, and forces the latter up against the openings G, so that further passage of the compressed air is stopped.

APPLICATIONS FOR LETTERS PATENT.

28,133.—Gregson, T., and Watmough, T., "Incandescent gas-burners." Dec. 20.

28,138.—Wadman-Smith, C. J. P., "Tar-gas generator." Dec. 20.

28,147.—Crossley, W. J., and Atkinson, J., "Cleaning producer or other kinds of gas." Dec. 20.

28,165.—Randall, W., "Utilization of exhaust gases from gas-engines." Dec. 20.

28,177.—Harrison, G., "Manufacture of water-gas." A communication from the Société Internationale du Gaz d'Eau Brevets Strache, Ste. Ame. Dec. 20.

St. David's Water and Gas Supply.—A special meeting of the St. David's Water and Gas Company was held last Wednesday for the purpose of considering the Company's application for a Provisional Order for raising more capital. Mr. R. Barnes, the Chairman, presided, and produced a draft of the Order, and read to the meeting the clause dealing with the raising of an additional £12,000. He stated that, so far as the Directors could estimate at present, they would not require more than £4000 for their additional works, the principal of which was the carrying of water to Solva, a rising seaport place not far from St. David's. A resolution approving of the Order, subject to any alterations or modifications that might be made therein by Parliament, was carried unanimously.

More Coal in Durham.—Messrs. Bolckow, Vaughan, and Co.'s new mining plant at Ferryhill has now reached an advanced stage. There are three pits, named respectively the Dean, the Chapter, and No. 3. The last-named shaft is already sunk to the required depth of 50 fathoms, and is 16-feet diameter; and a few days ago the first batch of hewers descended to work the top seam, which is only 15 fathoms from the surface. There will be three seams worked from this pit. The coal discovered is of high quality, and each seam is of a good workable height. When the sinking process is completed at the other two pits, they will have shafts about 150 fathoms deep, and 19 feet and 21 feet in diameter respectively. It is the intention of the Company to work the Brockwell seam only at these two pits. Already one of the shafts is more than 70 fathoms down, and the other about 40 fathoms. When they are ready for working, there will be 16 tubs in the Chapter pit at once, 14 in the Dean pit, and eight in the No. 3 pit.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Duty of the "Millenium" Burner.

SIR,—In one of my recently delivered Cantor Lectures at the Society of Arts, I spoke of the "Millenium" burner, as used in Berlin, giving a duty of 19·8 candles per cubic foot. I regret to find, however, that an error has been made by my informant in the consumption of gas. The real duty of the burner is from 28 to 31 English candles per cubic foot of gas consumed.

Jan 3, 1903. VIVIAN B. LEWES.

Incandescent Gas-Burners.

SIR,—May I again trespass upon your space to draw attention to another matter of importance which especially concerns the up keep of incandescent burners? Judging from the various new burners which from time to time have been brought under my notice, it would appear that the aim of most inventors has been to make, not only a better, but a different, burner to those almost universally in use. Probably for every pattern of patent burner fixed, there are a hundred of the so-called "C" type; and I would strongly urge the desirability of making, wherever possible, improved burners of such dimensions that the ordinary "C" mantles, props, shades, and even chimneys can be used on them. One of the disadvantages of the "Kern" burner is that it requires a special line of shades to suit its gallery, though probably there was a purpose in this. But the result has been, in our case, that its use has been considerably limited.

709, *Old Kent Road, S.E., Jan.* 1, 1903. CHARLES CARPENTER.

Inclined v. Horizontal Retorts.

SIR,—I have pleasure in answering the questions put by Mr. West, in his letter on the above subject last week, as follows: Men on the drawing-floor receive 40s., and those on the charging-floor 45s. They work nine and twelve hour shifts respectively.

Heckmondwike, Jan. 3, 1903. A. F. GOODSON.

Notable Experiences with Blue Water Gas at Ilford.

SIR,—In your article on this subject, I am unable to find anything startling in the results obtained at Ilford, as for some years past, with the "Economical" type of generator, we have been obtaining the same, or a greater, amount of gas per ton of coke used. The "blue water gas" from the "Economical" type of generator can, at the option of the Engineer, be utilized uncarburetted in the same manner as at Ilford, and similarly to the experiments that were carried out on this type of plant at the Crystal Palace District Company's works.

We are informed that "the candle power of the gas supplied at Ilford is 16 candles in the evening, and 15 candles during the day time." It is evident that this candle power is not derived from the "blue water gas," or the small amount of benzol and gas oil used. Therefore it must be derived from the coal. Before one is able to decide whether the cost of manufacturing the gas is reduced by the mixing of this "blue water gas," it would be necessary to know the cost of the coal gas made during the period of the test.

I think we are safe in making the statement that, if a comparison of the cost of the manufacture of the gas at Ilford were made with another works using carburetted water gas, the cost of the gas per candle delivered to the consumer would be considerably less than the cost of the gas per candle as now made at Ilford.

19, *Abingdon Street, S.W., Jan.* 1, 1903. J. T. WESTCOTT.

[The only point in this letter that requires reference here is the statement that Mr. Westcott is unable to find anything "startling" in the results obtained at Ilford. We did not assert that he or anyone else would. All we suggested was that the Ilford experience is noteworthy; and we give to that expression its fullest meaning. To the other points in the letter, perhaps Mr. Brown will respond.—ED. J.G.L.]

Penalties Attaching to Water Consumers' Offences.

SIR,—In the "JOURNAL" for Dec. 3, 1901, there was a letter from Mr. A. R. Cawley, of Llanelly, calling attention to the need of gas and water companies publishing short particulars of offences for which penalties may be imposed in accordance with section 145 of the Companies' Clauses Consolidation Act, 1845; and he enclosed a copy of the notice issued by the Llanelly Gaslight Company which you inserted, and which is of value as a precedent. I should be much obliged if a similar notice, applicable to water companies, could be furnished for the benefit of your readers.

41, *New Church Road, Brighton, Jan.* 1, 1903. W. A. HOUNSON.

The Choice of Gas-Fires.

SIR,—In connection with Mr. Fletcher's article in the "JOURNAL" or the 23rd ult., it may not be inopportune if I seek your courtesy to record the words of a bronchitis patient in favour of gas heating. The man, who had experienced a very severe attack, confining him to one room for three months, told me after recovery that his room had been constantly heated to regular temperature by a gas-fire. I asked him if he had suffered any sort of inconvenience. His reply was: "Not the slightest;" and he went on express his great satisfaction with the gas-stove, which was a Fletcher.

I may mention another case. An aunt of mine, who several times spent a fortnight with us in the early summer, had an occasional oppression in the throat as the result of bronchitis, from which she had never thoroughly recovered. When these attacks occurred, I persuaded her to let us light the gas-fire; and, very soon realizing its benefit, she would afterwards ask that the stove should be lit when fearing an attack.

There is still probably considerable prejudice in the public mind against the use of gas-stoves—mainly the result of ignorance, but in some degree attributable to the existence of a few bad stoves, lately referred to by Professor Lewes. My hope in writing to you is that the facts given may assist, in however small a degree, in lessening this prejudice.

182, *Brecknock Road, N., Jan.* 3, 1903. A. CLEVERLY.

LEGAL INTELLIGENCE.

Gas Stoker Fined for Neglecting Work.

At the Armagh Petty Sessions last Friday, William M'Kinney was summoned for breach of contract by the Armagh Gas Company. It was stated that the defendant was sent for on the previous Sunday, but when he arrived he said he was unfit to work. He was told to take off his coat and make a start; but he refused, and said he would go home. The Company were very short of gas, and the townspeople were put to much inconvenience. He was fined 5s. and 6s. costs.

An Ingenious Prepayment Meter Robber.

At the Halifax Borough Court, last Wednesday, James Grady was charged with having stolen 1s. 3d. in coppers from a penny-in-the-slot meter, the moneys of the Halifax Corporation. Mr. H. Ashling, the Assistant-Solicitor to the Corporation, stated that the offence was committed on Christmas Day. About four o'clock, prisoner went to the meter, prised it open with the poker, and took from it the sum mentioned. A curious feature in the case was the scheme which he concocted in order to avoid suspicion falling upon himself. He went to the Police Station, accompanied by his son, and there reported that his house had been entered by two men, who had made off with certain clothing, and forced open the gas-meter. It was a grand scheme; but prisoner had reckoned without the sergeant, who visited the house and saw the wife. From what he heard from her, and from what he saw in the house, the officer resolved upon questioning the lad. The result was that the latter confessed that he had himself seen his father open the meter and take the money from it. Prisoner pleaded "Not guilty." The lad was called, and bore out the statement of the prosecuting Solicitor. Prisoner protested that he was innocent; but as there were eleven previous convictions against him, he was sentenced to two months' hard labour.

Stealing Coke from a Gas-Works.

At the Gateshead Police Court last Friday week, a man named Mark was charged with stealing 5 cwt. of coke, valued at 3s. 1d., from the Redheugh works of the Newcastle and Gateshead Gas Company. Mr. Clark, who prosecuted, said that the coke had been secured by a very ingenious device. The man had, by pretence, got a token for 3 cwt. of coke—tokens being similar to accounts that had to be paid. Defendant had by this means succeeded in obtaining 5 cwt. in payment for 3 cwt., and 10 cwt. in payment for 5 cwt. William Dodds, weighman at the works, stated that on the 4th inst. the defendant came to have a cart weighed and to get some coke; and he was given a token. Later, he said that he had lost the token, and was given another one for 3 cwt. Next day he got another load of cinders—5 cwt.—and paid with a token for 3 cwt.; and afterwards he obtained 10 cwt. and paid for 5 cwt. Accused was sent to prison for two months.

Cutting off a Water Supply.

At the North London Police Court last month, the East London Water Company appeared, by Mr. D. A. Romain, to answer a summons, charging them with unlawfully neglecting or refusing to furnish Arthur Coleman with a supply of water. In support of the summons, it was stated that the complainant was asked for the amount due on his present premises, and also for a disputed account in regard to another house. He tendered the former amount; but the collector refused it, and the water was cut off. Complainant had been in the habit of paying his rates yearly. Mr. Romain said that, on the facts, he should call the collector, who would say that the tender in cash was never made; and on the law he should contend that when once a man got into arrear, the Company had a statutory right, under the Water-Works Clauses Act and their own Acts, to cut off the water. Mr. Fordham said the Company had acted illegally in cutting off the water after the tender had been made, and they would have to pay a penalty of £7, with £3 costs. He agreed, however, to state a case on the point of law.

Stafford Water Supply.—An application having been made to the Local Government Board by the Stafford Corporation for additional borrowing powers in regard to water-works extensions, Mr. E. P. Burd, one of the Board's Inspectors, recently held a public inquiry on the matter at the Guildhall. Already £47,000 has been borrowed for the purposes of the water-works, and the application was for power to raise another £5000, and a sum in addition for carrying out an extension of the mains. No opposition was offered to the application.

MISCELLANEOUS NEWS.

GAS v. ELECTRICITY FOR MOTIVE POWER.

A Comparison of Prices.

In view of the fact that electric current employed for motive power is being supplied in York at prices varying from 1¼d. to 1d. per unit, according to the quantity used, Messrs. Crossley Bros., Limited, have issued a circular pointing out that this must be considerably less than the cost, seeing that the net cost for 1901 in 108 towns, from the published returns, works out to 2¼d. per unit. Messrs. Crossley say that, even at these prices, a few authoritative figures, comparing the cost of producing power by electric motors and by gas-engines, are of the greatest importance to the business world; and they accordingly furnish them. The consumption of medium-sized gas-engines (say 10 brake horse power) is 16 cubic feet per brake horse power per hour, when working at full load. With gas costing 1s. 11d. to 2s. 2d. per 1000 cubic feet, less 10 per cent. discount (the prices at which gas is supplied for power in York), the cost of producing 1 brake horse power is only a trifle over one-third of a penny (0·332 to 0·374d.) per hour. An electrical unit is 1·3-horse power; but the very best electric motors give only 90 per cent. efficiency when new, and a small motor will not give anything like such good results. In the case of an electric motor of medium size (say 10 brake horse power), therefore, 1 brake horse power per unit would probably be the limit obtained. Taking this basis as an average, the consumer would have to pay three times as much to do by electricity what can be done with equal facility by coal gas. Owing to the high speed at which an electric motor is run, the wear and tear must be very heavy; and, in the opinion of experts, quite twice as much as in the case of a gas-engine. Messrs. Crossley acknowledge that in certain positions, and for very intermittent work, electric motors have advantages; but looked at from the broad point of economy, they say there can be no question that gas-engines are far and away the cheapest power generators at present available for both small and large users. Those who do prefer electricity to gas for lighting or any other purpose, may be surprised to learn that it is now much cheaper in York to generate electric energy by means of a Crossley gas-engine and dynamo combined, than it is to take it from the town supply. A Board of Trade unit of electricity, at the present price of York gas, can be obtained by this means for less than ½d.—the cost of gas. This statement is verified by a letter received from a firm in the city, who, with a 30-horse power nominal Crossley gas-engine, are running 22 8-ampere and 20 10-ampere arc lamps, as well as about 450 16-candle power glow lamps—altogether equivalent to about 85 brake horse power when at full. The engine has been running a little more than two years, and the firm say it gives every satisfaction both in steadiness of running and consumption of gas, which works out at 16 cubic feet per brake horse power per hour on full load. We have only to remark, in connection with the above, that if gas can compete with electricity so well now, its position as a supplier of power will soon be greatly strengthened, for the Secretary and Manager of the York Gas Company (Mr. M. Leaf) announces that the Directors have decided that, commencing with the March quarter, they will allow a discount of 10 per cent. off all accounts for gas consumed by engines, if paid within the month following that in which the quarterly account is due. This reduction will make the net cash prices for gas registered for engine purposes, from the 1st inst., range from 1s. 8¾d. to 1s. 11½d. per 1000 cubic feet, according to consumption.

SETTLEMENT OF RATING APPEALS.

Two important rating appeals have been settled within the past few days. The Plymouth Gas Company appealed against an increased rating from £4233 to £5200. The case has been pending for some time, and would have been heard on Jan. 2. Intimation, however, was conveyed to the Clerk of the Assessment Committee that the Company had withdrawn their appeal, and had accepted the new rating.

The assessment of the Yeovil Corporation Gas-Works was raised from £523 to £2500. The Corporation gave notice of appeal, which would have been heard at Taunton on Jan. 6. The Assessment Committee, however, offered by way of compromise to reduce the assessment from £2500 to £1400. This has been accepted by the Gas Committee, and the appeal is therefore withdrawn.

In the former of these cases, Messrs. Ryde and Sons, Messrs. Eve and Son, and Messrs. William A. Valon and Son were retained by the Assessment Committee; and Mr. William Marshall and Messrs. Corbet Woodall and Son were advising the Gas Company. In the second case Messrs. Valon and Son were advising the Yeovil Corporation, and Messrs. Castle the Assessment Committee.

LAST YEAR'S GAS CONSUMPTION IN MANCHESTER.

Mr. Charles Nickson, the Superintendent of the Gas Department of the Manchester Corporation, has given to a representative of the "Manchester Guardian" the following particulars in regard to the gas supply of the city and the suburbs in the past year, and other interesting statistics. The quantity of gas consumed in the quarter just ended was 1,583,173,000 cubic feet. This was 52,243,000 cubic feet, or 3·19 per cent., below the figures for the corresponding quarter of 1901. The open season and the extent to which incandescent burners are now used account, it is said, for this slight decrease. Taking the returns for the three quarters April to December, there is an increase of 1·30 per cent. in the consumption as compared with the corresponding quarters in 1901. The figures are 3,325,106,000 cubic feet, against 3,282,526,000 cubic feet, or an increase of 42,580,000 cubic feet. It is interesting to compare the "record day" of the past year (Dec. 16) with the "record day" for all time as regards Manchester. The highest figure was reached on Dec. 27, 1899, when 26,164,000 cubic feet of gas were consumed in the 24 hours. On the 16th ult., the consumption was 23,275,000 cubic feet, or 11·04 per cent. under that day's consumption three years ago. The "record week" in the gas annals of Manchester is that which came just before Christmas, 1901 (Dec. 18 to 24). In that period there were 154,159,000 cubic feet of gas consumed. In the corresponding week of last year the consumption was 142,532,000 cubic feet, or a decrease of 7·54 per cent. December, 1901, was the "record month;" 622,361,000 cubic feet of gas being consumed. In the month just ended, the consumption was 609,988,000 cubic feet—a decline of 1·99 per cent. The consumption for the whole of last year was satisfactory to the Gas Committee. It amounted to 4,883,726,000 cubic feet. The highest of any previous year was 4,815,954,000 feet, which was 1·41 less per cent. than the consumption last year. It is the wish of the Committee to extend the best forms of street lighting. They have erected 999 new lamps, and have fitted them with 3202 incandescent burners. In some parts of the city the Committee, acting in conjunction with the Tramways Committee, have affixed with excellent effect twin lamps, fitted with incandescent burners (four in each lamp), to the side poles which keep the trolley wires in position.

DARLINGTON GAS-WORKS EXTENSIONS.

Proposed Loan of £100,000.

An inquiry on behalf of the Local Government Board was held a few days ago by Mr. J. C. Pottinger, one of the Inspectors, at the Town Hall, Darlington, with regard to an application made by the Corporation for a Provisional Order to enable them to borrow more money for the purposes of their gas undertaking. The Town Clerk (Mr. H. G. Steavenson) explained that the total borrowing powers granted in connection with the Gas Department amounted to £153,000, and the total outstanding loans in connection with the Local Government Acts came to £25,853. The application was made in pursuance of a resolution of the Council of the 10th of November last to apply for a further sum of £100,000. The gas-works had been enlarged from time to time under the powers of the Local Acts of 1854, 1861, and 1872; and the additional money was required to defray the cost of further extensions and additional gas-producing plant to meet the increasing demand for gas. Though the Corporation had been aware for some time of the need for these extensions, they had deferred undertaking them until they saw whether the increased use of the electric light would diminish the demand for gas. This had not been the case; and it furnished another instance of what was pretty generally known—that where the light was running in competition with gas, it did not in any way cause a diminution in the demand for the older illuminant. In 1898, Mr. J. Hepworth reported very strongly in favour of immediate extensions being carried out; but nothing was done until, in October last, Mr. Tarratt, the Engineer, also reported to the same effect. In the borough there were 8600 gas-meters and 3200 gas-stoves. The productive capacity of the works at present was 1,800,000 cubic feet per day, and the estimated maximum delivery in one day recently was 1,780,000 cubic feet. The gas made during the twelve months ending the 21st ult. was 324,763,000 cubic feet—or an increase on the previous year of 21,970,000 cubic feet, or upwards of 7 per cent. A statement for the past ten years showed a general increase of 6·4 per cent. per annum. When the extensions were completed, the productive capacity of the works would be increased by 2,000,000 cubic feet, and would give a daily total of 3,800,000 cubic feet. Based upon an estimated increase of 7 per cent., the production would then only exceed the requirements of the town by 306,000 cubic feet. As showing the growth of the town, he pointed out that the number of houses approved had increased from 343 in 1898 to 496 in 1902. From their general knowledge of the district, the Corporation believed this increase would be maintained. Last year the net profit on the gas-works was £6967. The original cost of the works and extensions up to September last was £132,594, less £2961 paid out of revenue. The loans repaid were £77,990; leaving the outstanding loans £51,649.

THE CRYSTAL PALACE DISTRICT GAS COMPANY'S EMPLOYEES HONOUR THEIR CHAIRMAN.

The Inception and Development of Co-Partnership in Gas-Works.

Through circumstances over which they have not the slightest control, the employees of the Crystal Palace District Gas Company are not brought into such frequent and intimate contact with their Chairman (Sir George Livesey) as are their friends of the South Metropolitan Gas Company; and consequently they have not had such opportunities as have the latter for showing him, directly and collectively, their appreciation of his devotion to the amelioration of their conditions—both working and social. But they have now made an opportunity; and when a body of true British working men take a "job" in hand, they do not, as a rule, allow the want of the turning of a stone to prevent their arriving at the desired end. And so it has come to pass that the laudable wish of the Crystal Palace District Gas Company's men to be on a level with their comrades of the large neighbouring Company in doing honour to their Chairman has been fulfilled. Without so much as "by your leave," they arranged to present him with a gift which he could preserve as a memento of the value they set upon his work for them; and then they invited him to meet them in the recreation room on the works at Sydenham after the Board meeting last Friday. Nothing, experience enables us to easily assert, makes Sir George so pliant as a request from the men of either of the Companies to meet them; and so he readily complied. In the matter of the presentations

that have been made to him, they have all been the spontaneous acts of the men; and so he is able to accept them with the knowledge that those who give derive as much pleasure from the act as he himself does in receiving the token of their regard. On the former point, in the present instance, the intention of the men to make the presentation was all "cut-and-dried" before even the officials were made acquainted with it; and on the latter point, as to the pleasure of the men, any scepticism or cynicism which an onlooker at last Friday's little event might have previously entertained in regard to it, would have been rudely shattered by the honest joy reflected on the faces of the men and by the heartiness of their cheers.

There must have been nearly 300 men in the recreation room during the proceedings; and they were not there out of any idle curiosity. This was a "pie" in which they all had had a finger; and therefore it was their business. The fact that most of them were straight from duty and in their working clothes did not trouble them; they were there for a purpose, and that was sufficient for them. On the platform table was placed their gift. It was a solid silver salver of pretty design; and it bears, in brief and simple terms, the information that it was "Presented to Sir George Livesey by the Workmen of the Crystal Palace District Gas Company as a Mark of Gratitude for the Many Benefits he has conferred upon them—especially the Profit-Sharing Scheme." Mr. S. Y. Shoubridge, the Company's Engineer, was in the chair; and, after a suitable little preface, he called upon Mr. Butler, as the chosen representative of the men on this occasion, to make the presentation. In his opening remarks, Mr. Butler described Sir George as the men's "friend;" and then proceeded to justify the description by referring to the privileges—particularly that of the profit-sharing scheme—that the men now enjoyed through his initiative. Asking Sir George to accept the gift, he said it was a token of the men's high esteem, and a recognition by them of the generous and valuable services he had rendered on their behalf. It was their hope that he would be spared to them for many years to be their "guiding star;" and they trusted that the New Year would be a bright one for both Sir George and Lady Livesey. The men enthusiastically confirmed the happily expressed sentiments.

Sir George Livesey, in his response, took the opportunity of addressing the men on several points of special interest to them, and of which they are in a few days to have a full report. Naturally, as he has not lately had an opportunity of addressing the Crystal Palace Gas Company's employees, to some extent he had to pass over ground with which readers of the "JOURNAL" have already been made acquainted. But there are a few matters which will prove of interest to them in connection with the profit-sharing question. In the first place, he heartily wished the men "A Happy New Year;" and then spoke of the surprise the presentation had occasioned him, and of his great appreciation. A little later he made an interesting statement in regard to the inception of the profit-sharing system at the South Metropolitan Gas-Works. In this connection, he said he was told that this presentation was made partly as a recognition of his efforts in the introduction of profit-sharing. He was not the only one who deserved credit for that. It was true he was perhaps the first to suggest it in connection with gas companies; and it came about just before the strike of the gas stokers of the South Metropolitan Gas Company in 1889. He thought he might say that a workman was really the originator—a man who had been a workman, but was at the time he was referring to the foreman at the Old Kent Road works. He came to him one day and said, "Now, sir, you will have to do something to attach the yardmen and mechanics to the Company; for if you don't, they will be forced into the Union against their will. The Union has forced all the stokers in; and they have threatened that, if the yard men and mechanics do not join the Union now, the entrance fee [which was 2s. 6d. then] will be raised in a month to £1. If they do not join, they are told, they will not be allowed to work here." That foreman was Mr. Charles Tanner. Then, by a sort of inspiration, the idea of a profit-sharing scheme came into his (Sir George's) mind. It was not new to him, because the principle was not new. But he had long entertained the idea that the interests of employer and employed were identical, and that they ought to be made practically so in some way. The profit-sharing system seemed the way that was most feasible. He proposed it to the Board of Directors; and they all agreed with it there and then. He then sent for about nine representative workmen. Three of them were stokers; and the rest were yardmen and mechanics. They all said it was a fine thing, and wished it had been introduced before. The yard men and mechanics at once said they would be only too glad to accept it; but the stokers said they must consult the Union before they gave an answer. The Union ordered them not to accept the scheme. It was offered by the Directors to all the men who chose to accept it; and they were told they would not be asked to say anything as to whether they were in the Union or not. They were informed that, if they chose to accept the proposal, and sign the agreement, they should have it, even if only fifty or even ten signified their acceptance. But 1000 men accepted it; and then the Union protested against it, and objected to the 1000 loyal men being continued in the service. But the answer of the Board was that, under no circumstances, would they remove these men; and then the strike came. That was the story of the starting, in storm and stress, of the profit-sharing shareholding system in gas-works. It had worked so well in the case of the South Metropolitan Company, that he felt it was only right, in the interests of the Company as well as of the employees, that it should be introduced into the Crystal Palace Gas Company's works. This was done in 1894, by which time the Union had learnt wisdom; and they made no objection. The Union men signed the agreements; and they had all worked together as pleasantly as possible ever since. They had given him credit for this movement. It was true that the credit for suggesting it was his; but what could one man do single-handed? He was sorry to say that of the gentlemen who composed the Board of the Crystal Palace Gas Company then, four of them had gone to their account and rest. Fortunately, when he proposed the introduction of the system, they

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 22.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Oct. 15	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	12½—13½	..	5 11 1
200,000	5	Nov. 13	6⅝	Bombay, Ltd.	5⅝—6	..	5 8 4
40,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 6
380,000	Stk.	Aug. 14	12	Brentford Consolidated	247—252	..	4 15 3
270,000	,,	,,	9	Do. New	180—185	..	4 17 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	134—139	..	3 11 11
206,250	,,	Dec. 11	4	Do. 4 p.c. Deb.	110—113	..	3 10 10
220,000	Stk.	Sept. 11	10⅜	Brighton & Hove Orig.	207—212	..	5 1 5
246,320	,,	,,	7⅛	Do. A. Ord. Stk.	152—157	..	4 18 9
460,000	20	Sept. 26	10	British	39½—40½	..	4 18 9
50,000	10	Aug. 14	12	Bromley, Ord. 10 p.c.	—	..	—
82,850	10	,,	9	Do. 7 p.c.	—	..	—
500,000	10	Oct 15	7	Buenos Ayres (New) Ltd.	10½—10⅝	+⅛	6 10 3
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	92—94*	..	4 5 1
150,000	20	July 11	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	Sept. 26	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	Nov. 3	6	Do. 6 p.c. 1st Mort.	53—55	..	5 9 1
550,000	Stk.	Oct. 15	12½	Commercial Old Stock	—	..	—
251,875	,,	,,	5½	Do. New do.	—	..	—
271,875	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	130—134	..	3 7 2
800,000	Stk.	Dec. 11	8	Continental Union, Ltd.	133—138	..	5 15 11
200,000	,,	,,	7	Do. 7 p.c. Pref.	140—145	..	4 16 7
575,000	Stk.	Aug. 28	5⅛	Crystal Palace Ord. 5 p.c.	117—122	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
106,158	,,	July 11	5	Do. 5 p.c. Deb. Stk.	139—142	..	3 10 5
486,090	10	July 30	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Aug. 14	4	Gas-light and Coke — 4 p.c. Ord.	85—87	+1	4 12 0
2,600,000	,,	,,	3½	Gas-light and Coke — 3½ p.c. max.	85—87	−1	4 0 6
3,799,735	,,	,,	4	Gas-light and Coke — 4 p.c. Con. Pref.	110—112	..	3 11 5
4,193,975	,,	Dec. 11	3	Gas-light and Coke — 3 p.c. Con. Deb.	91—93	..	3 4 6
232,500	Stk.	Sept. 11	5	Hastings & St. L. 3½ p.c.	90—95	..	5 5 3
70,000	10	Oct. 30	8	Hongkong & China, Ltd.	14½—15½	..	5 3 3
3,800,000	Stk.	Nov. 13	10	Imperial Continental	202—205	+1	4 17 7
473,600	Stk.	Aug. 14	3½	Do. 3½ p.c. Deb. Red.	99—101	..	3 9 4
158,200	Stk.	Aug. 28	6	Lea Bridge Ord. 5 p.c.	115—120	..	5 0 0
561,000	Stk.	Aug. 28	10	Liverpool United A	224—226	..	4 8 6
718,100	,,	,,	7	Do. do. B	165—167	..	4 3 10
306,083	,,	Dec. 31	4	Do. do. Deb. Stk.	114—116*	..	3 9 0
75,000	5	Dec. 11	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of — 5 p.c. Deb.	104—108	..	4 12 7
250,000	100	,,	4½	Melbourne — 4½ p.c. Deb.	103—105	+1	4 5 9
541,920	20	Nov. 13	5½	Monte Video, Ltd.	9—10	..	7 0 0
1,515,892	Stk.	Aug 8	4½	Newc'tle &G'tesh'd Con.	104—105	..	4 5 9
346,855	Stk.	Jan. 2	3½	Do. 3½ p.c. Deb.	97—98*	..	3 11 5
300,000	Stk.	Nov. 27	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Sept. 26	7	Ottoman, Ltd.	6½—7	..	5 0 0
					* Ex. div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
105,005	Stk.	June 24	5⅜	Ply'mth & St'house 5 p.c	125—130	..	4 8 6
851,070	10	Oct. 15	7	River Plate Ord.	10½—10⅝	+⅛	6 10 3
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	92—94*	..	4 5 1
250,000	10	Sept. 26	8	San Paulo, Ltd.	11½—12½	..	6 8 0
135,000	Stk.	Sept. 11	10	Sheffield A	236—238	..	4 4 0
209,984	,,	,,	10	Do. B	235—237	..	4 4 5
523,498	,,	,,	10	Do. C	233—235	..	4 5 1
103,235	Stk.	Sept. 26	5	Shrewsbury Ord. 5 p.c.	113—116	..	4 6 2
6,000,000	Stk.	Aug. 14	5½	South Met., 4 p.c. Ord.	119—122	+3	4 7 5
1,700,000	,,	July 11	3	Do. 3 p.c. Deb.	92—94	..	3 3 10
380,940	Stk.	Nov. 13	5	Southampton Ord.	103—107	..	4 13 6
87,950	,,	July 11	4	Do. 4 p.c. Deb.	102—105	..	3 16 2
120,000	Stk.	Aug. 28	6	Tottenham and Edmonton — A. 5 p.c.	118—123	..	4 17 7
300,520	,,	,,	4½	Tottenham and Edmonton — B. 3½ p.c.	93—96	..	4 13 9
182,380	10	Dec. 30	5	Tuscan, Ltd.	8½—9½*	+1	5 5 3
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	94—96*	..	5 4 2
230,000	5	Aug. 14	c½	West Ham, 10 p.c.	10—11	..	4 6 4
172,000	10	,,	6½	Do. 7 p.c.	13½—14½	..	4 9 8
				WATER COMPANIES.			
780,662	Stk.	Dec. 30	11⅝	Chelsea, Ord.	315—325*	+5⅝	3 10 9
150,000	,,	,,	5	Do. 5 p.c. Pref.	150—155*	+⅝	3 4 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	138—143*	..	3 2 11
175,785	,,	Sept. 26	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
1,720,560	Stk.	Oct. 15	8	East London, Ord.	225—235	..	3 8 2
654,740	,,	Dec. 11	4½	Do. 4½ p.c. Deb.	142—147	..	3 1 3
1,282,943	,,	,,	3	Do. 3 p.c. Deb.	97—99	+1	3 0 7
700,000	50	Dec. 11	8	Grand Junction — 10 p.c. max.	115—120	+2	3 6 8
310,000	Stk.	Sept. 26	4	Grand Junction — 4 p.c. Deb.	125—130	..	3 1 7
708,000	Stk.	Aug. 14	14	Kent	305—315	+5	4 8 11
160,000	,,	,,	7	Do. New, 7 p.c. max.	200—210	..	3 6 8
1,043,800	100	Dec. 30	11	Lambeth, 10 p.c. max.	305—315*	..	3 9 10
406,200	100	,,	8⅝	Do. 7½ p.c. max.	220—230*	..	3 13 11
350,000	Stk.	Sept. 26	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
500,000	100	Aug. 14	12⅝	New River, New Shares	395—405	..	3 3 2
1,000,000	Stk.	July 30	4	Do. 4 p.c. Deb.	125—130	..	3 1 7
902,300	Stk.	Dec. 11	7	South-wark and Vauxhall — Ord.	207—212	+2	3 6 0
126 500	100	,,	7	South-wark and Vauxhall — 7½ p.c. max.	200—210	+5	3 6 8
489,200	Stk.	,,	5	South-wark and Vauxhall — 5 p.c. Pref.	151—154	..	3 4 11
1,019,585	,,	Oct. 15	4	Vauxhall 4 p.c. A Deb.	125—130	..	3 1 7
1,155,066	Stk.	Dec. 11	10	West Middlesex	295—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p.c. Deb.	140—145	..	3 2 1
200,000	,,	Sept. 11	3	Do. 3 p.c. Deb.	97—99	..	3 0 7
					* Ex. div.		

all agreed with him; and his present colleagues—every one of them—were thoroughly convinced as to the soundness and the advantages of the principle of profit-sharing. Therefore the men had not only to thank him but them for their hearty support of the principles in which he and the employees believed. The officers, he might say, had also gone heart and soul into it; and in this connection he should like to mention the name of Mr. Jones, the Honorary Secretary of the Profit-Sharing Committee. But there was another party to whom gratitude was due. It would not be much good the Directors, officers, and others introducing the profit-sharing system, if the men themselves threw cold water on it, and said they would have "none of it." The success of profit-sharing was due quite as much to the workmen as to anybody else. If they had not assisted loyally and heartily to carry it out, by using the opportunity it gave them of becoming owners of property and shareholders in the Company, profit-sharing would have been a failure. Sir George went on to show that the system had abundantly fulfilled the necessary condition to success of being mutually advantageous to the companies who had adopted it and the employees; and then he referred to the changed relationship that had been induced between employers and employed by its introduction in the case of the Commercial Gas Company. This, too, had been the former experience of the South Metropolitan and Crystal Palace District Gas Companies. As to the financial result, the men of the latter Company had done better than those of the former. In the case of the South Metropolitan men, they had accumulated in the Company an average of £40 per man in thirteen years, or an aggregate of £160,000. But the Crystal Palace Gas Company's men had accumulated in eight years an average of £30 per man, which was better than £40 in thirteen years. They had accumulated rather over £12,000 of stock in the Company, and had nearly £4000 on deposit—making in all £16,000. This was a result that one could never have expected or dreamt of. The kind allusion made to, and reception given to the name of, Lady Livesey led Sir George to exhort the men to be true to themselves, and to love and cherish their wives and families. As he was concluding, he was reminded by one of his colleagues (Mr. Jabez Light) that the Company were applying to Parliament for further powers, and, among other things, to allow the profit-sharing employees to elect two of their number (possessing stock to the extent of £100 each) to take part in the direction of the affairs of the Company. This was an experiment that had been in operation in connection with the South Metropolitan Gas Company for four years. They had two of the workmen on the Board and one officer, who was a pay clerk at Vauxhall. These three gentlemen—he said "gentlemen" because they had behaved themselves as such—had proved themselves perfectly fitted for the responsibility, and they had been very useful to the Board. Not a single thing had been kept from them in connection with the business of the Company; and they had not betrayed their trust in any way whatever. Having been successful there, the Directors of the Crystal Palace Gas Company thought the time had come when they might introduce the same system. If the Bill passed, this time next year they would be thinking about the election of employee Directors. This, he thought, would show the men that the Board wished to work cordially and heartily with them. Once more Sir George warmly thanked the men, on behalf of himself and his wife, for their handsome present.

Speaking for himself and his fellow-Directors, Sir Fortescue Flannery, M.P., expressed their sympathy with the object of the employees in making this presentation. He said that not only were the members of the Board in favour of the profit-sharing system, but they were most desirous of supporting it, and seeing it extended so that every employee in the Company, in the course of time, should have a definite and direct interest as a proprietor of the concern. It was Sir George Livesey's own suggestion, when the Board were arranging the details of the Bill, that a clause was inserted providing for the election of Workmen Directors, so that they might bring their experience and knowledge, and the representation of their fellow-men, to the Board. Speaking as a member of the House of Commons, he had no doubt that Parliament would sanction the scheme. In his final remarks, he said that profit sharing had established a new era in the industrial world; and he believed that years hence—when all who were present had passed away, leaving only the memory of their names behind them—it would still be remembered that, in this system of bringing the worker and the employer together in a common interest, the name of Sir George Livesey had had a most prominent part; and it would be long before that name was forgotten as being that of one who had benefited alike the working man and all associated with him. (Applause.)

Cheers for Sir George and Lady Livesey were again enthusiastically given. With a few more words of thanks from the former for this demonstration and for the handsome testimonial, this happy halt in the daily routine of the works ended.

Shortly afterwards, on the Directors reassembling in the Board-room, the officers rounded off the testimonial by handing to their Chairman, through Mr. Shoubridge, a beautiful set of silver ornaments—comprising a silver Edwardian rose bowl and a pair of cups. On the stand of the former was an appropriate inscription. Mr. Shoubridge (who was supported by Mr. Charles M. Ohren and all the Company's officials) asked Sir George to accept the gifts as an expression of the high regard in which the whole of the officers held him, and as a token of their gratitude for the great personal interest he took in them, and for the many benefits he had been instrumental in conferring upon them. It was their earnest hope that Sir George would live long to preside over the Company. These remarks were heartily endorsed by all present. In his response, Sir George had once more to acknowledge that this mark of goodwill came upon him as a complete surprise. He mentioned that, though he had not the pleasure of a personal acquaintance with each one of the staff, he could assure them that he took a keen personal interest in their prosperity. He spoke of the great responsibility resting upon the officers, and concluded by heartily thanking them for this evidence of the kindly feeling they bore him.

IMPORTANT PRELIMINARY ANNOUNCEMENT!

The Somzée Greyson Intensified Gas-Light Syndicate, Limited, the **PIONEERS OF HIGH-PRESSURE INCANDESCENT GAS LIGHTING** in this Country and the Colonies, have much pleasure in informing Corporations and Gas Companies that, having introduced **SEVERAL IMPORTANT AND FAR-REACHING IMPROVEMENTS IN THIS SYSTEM,** and also in **LOW-PRESSURE LIGHTING,** they propose to commence business operations on a large scale at an early date.

Fuller Particulars will appear in a subsequent issue of this Journal.

Please carefully note the following Addresses:

THE

SOMZÉE GREYSON INTENSIFIED GAS-LIGHT SYNDICATE

LIMITED.

Offices: 36, Victoria Street, Westminster, London, S.W.

Show-Rooms: York Mansions, York Street, Westminster, London, S.W.

ELECTRIC LIGHTING NOTES.

A Failure at Ventnor.

The fact of Ventnor being plunged in darkness for nearly half-an-hour last Wednesday—both private and public lights being extinguished throughout the district, at the busiest time of the year—is much too insignificant a matter for notice in the local channels of information. So we learn from a Portsmouth paper that, among other inconveniences, candles had to be resorted to at the Post Office in order to get off the last mail.

Electricity Works Transfer at Norwich.

At a special meeting held last Tuesday, the Norwich Town Council adopted a recommendation of the Finance Committee that, under the provisions of the Norwich Corporation (Electricity, &c.) Act, 1902, a sum of £210,000 be borrowed for the purchase of the undertaking of the Norwich Electricity Company, Limited, and for defraying the costs and expenses incident to such purchase, and to the transfer of the undertaking to the Corporation (other than the cost of the Act), and for the construction of additional works. The sum is to be raised by the creation and issue of an adequate amount of Corporation stock, as authorized by the above-named Act and by the Norwich Corporation Act, 1889.

Another Failure in the City.

Considerable inconvenience was caused in the immediate vicinity of the Mansion House last Friday afternoon by the failure of the electric light. The breakdown occurred soon after four o'clock. Many shops and business houses and a number of banks were suddenly left in darkness, and the street-lamps were extinguished. As a result, business could only be carried on with difficulty, and the congestion of the traffic opposite the Mansion House was greater than usual. About five o'clock the majority of the lamps were again lighted, though a few places remained in darkness for a longer period. The Engineer to the City of London Electric Lighting Company states that the failure of the current affected about 8000 lights in the neighbourhood of the Royal Exchange—about 2 per cent. of the lights in the City.

Municipal Electric Light Works and Depreciation.

Mr. H. W. Pulleyn, the professional Auditor of the accounts of the York Corporation, has offered to the Finance Committee a few pertinent remarks on the position of the electric light undertaking. He has observed with regret that the members of the Council have not considered it necessary to adopt the recommendation contained in his last report as to the advisability of charging depreciation against the revenue account. He points out that, having regard to the fact that the Local Government Board allow 25 years for the redemption of the electric lighting loans, it may fairly be assumed that the average life of the assets acquired with the money provided by these loans is less than the authorized term for repayment, and therefore the provision out of revenue for sinking fund instalments to redeem the loans is not of itself sufficient. This financial policy, he says, will ultimately result in the cost of replacement of plant falling against the year in which such replacement has to be made, instead of being distributed evenly over a period covering the life of the plant. Consequently, revenue will be overstated during the earlier years of the undertaking at the expense of the later years. Under these circumstances, he feels it to be obligatory upon him to point out that any future balance of profits apparently available for the relief of the rates will be "purely fictitious unless the claims of depreciation are recognized."

Exeter's New Generating Station.

An important step in the development of the Exeter municipal electricity undertaking was taken last Thursday, when the foundation stone of the new generating station was laid. The ceremony was performed by Mr. E. J. Domville, who took an active part in the purchase of the original electric light undertaking from the Company who founded it, and was from 1895 until last year, when he retired from the Council, Chairman of the Electric Lighting Committee of the Corporation. The new station is to cost £68,000, of which sum £14,000 is to be spent on the building. Mr. Domville said the Municipality owed much to those who founded and carried on the Electric Light Company; but unfortunately for those who invested their money in that undertaking, though fortunately for the city, the Company did not prove a success, and practically the whole of the £24,000 invested was sunk in obtaining a business and goodwill on which the Corporation had been able to flourish. Since they obtained possession of the concern, they had, out of the revenue, paid not only the interest, but £5000 towards the repayment of the £18,000 borrowed, and £4000 had been set aside as a contingent fund. At the conclusion of the ceremony, Mr. H. A. Willey entertained the Mayor and Corporation at luncheon at his works, which adjoin the site of the new station. Messrs. Willey and Co. are manufacturing the ironwork for the roofs of the buildings, and they have also a business connection with the Westinghouse Company who secured the contract for the equipment. In proposing "Success to the new works," Mr. Willey congratulated the city on the step they had taken, and expressed his belief that the Gas Company had nothing to fear from the competition of the electric light. Mr. W. Wreford, Chairman of the Electric Lighting Committee, responded to the toast. The Mayor proposed the health of Mr. Willey, and spoke highly of the services he had rendered in advancing the trade of the city. The toast was cordially honoured.

A Municipal Scheme Rejected.

An important decision was come to by a meeting of the ratepayers of Tiverton yesterday week. The Town Council had decided, by a majority of one, to carry out a municipal scheme of electric lighting at a cost of about £9000. Considerable doubt was expressed in the Council as to the possibility of making such a scheme pay—indeed, the Lighting Committee, who had considered the matter, had reported in favour of the acceptance of an offer which had been received to lease

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and work the Provisional Order. The doubt felt by many members of the Council as to the possibility of profitably working a municipal electricity undertaking was shared by a large number of the ratepayers; and the meeting was summoned by the Mayor (Mr. Lake) in response to a numerously signed requisition. Mr. J. Carpenter moved a resolution requesting the Town Council to reverse their decision in favour of a municipal scheme. He said he regretted that the Corporation were pledged to the principle of electric lighting, and was convinced that the effect of the proposed installation would be to damage their gas-works. In any case, profit was very doubtful; and he did not believe that any member of the Council would care to invest in such a scheme on the basis of the Borough Engineer's estimate. The resolution was seconded by Mr. F. R. Clutsome, and carried without dissent. Mr. H. S. Thomas then proposed that the Council be asked to accept an offer from a Company to take over the Provisional Order and work it. He contended that this was a business for experts, and that in every place where an electricity undertaking had been attempted by other than experts, the result had been failure. Mr. R. F. Loosemore pointed out that the Council had rejected an offer from Messrs. Christy by 13 votes to 6, and suggested that, if they were not to have a municipal scheme, they should arrange for some outside firm to undertake the business entirely on its own responsibility. Considerable discussion followed, in the course of which the Borough Engineer (Mr. Siddals) expressed the opinion that, of the offers which the Corporation had received, the one of Messrs. Christy was the most advantageous; and the meeting ultimately adopted a resolution recommending this proposal to the Council. This decision supports the recommendation of the Lighting Committee. Messrs. Christy's proposal is to take a lease for 21 years of the Provisional Order, and of the works to be erected under it. The capital outlay to be provided by the Council is £10,000, and the lessees will receive, as contractors and designers, 15 per cent. on the net cost. With regard to the working of the undertaking, Messrs. Christy agree to pay the interest and sinking fund, and to hand over to the Council one-third of the net profits. The Corporation are to be guaranteed against loss.

The Fatality at the Fulham Baths.

The inquiry into the circumstances attending the deaths of William Brown and William A. Line, which occurred at the Fulham Baths on the evening of the 23rd ult., as recorded in the "JOURNAL" last week (p. 1764), was resumed on Saturday by Mr. C. Luxmore Drew. Mr. Hudson appeared for the Fulham Corporation; Mr. J. W. Moyses and Mr. C. F. Appleton represented the relatives of the deceased; Mr. Marriott, the National Wiring Company, who carried out the electrical part of the equipment of the baths; and Mr. G. S. Ram was in attendance for the Home Office. The first witnesses called were Mr. H. C. Sampson and Mr. H. Bell, who deposed to having received slight shocks on touching the partitions of the baths. Mr. H. Pearson, the architect who drew up the specification for the baths, stated that in the slipper baths the partitions were made of enamelled plate, and at the top were galvanized iron caps on which rested the metal tubes containing the electric wires. The floors rested on expanded steel, covered with several inches of concrete. He originated the idea of having the tubes containing the wires on the top of the partitions. He thought the whole system of electric lighting was quite safe provided his specifications were carried out. The Electrical Engineer had passed the work as satisfactory. The leakage of current must have occurred through some defect in the wires. In reply to Mr. Ram, witness said the tube method was the safest for buildings such as the baths in question. Mr. F. H. Medhurst stated that since the accident he had been requested by the Borough Council to make inquiries into the matter. In his opinion, the men had put their hands on the metal capping of the partition where the leakage was, and had stood on the metal disc of the waste-pipe in the baths, thus completing the circuit. Their bodies had offered a very low resistance to the passage of the current. The deceased had received a shock of 165 volts. He found that the defect was in the connection between the wires and the lamp-holders to which they were attached. The cause of the leakage was that the specification had not been followed, and that the tubes containing the wires were not earthed. If the specification had been properly carried out, it would have been impossible for anyone to receive even an inconvenient shock; and if the metal tubes had been earthed, the leakage would have been discovered by the safety fuses melting. Perfect safety could have been secured for about 1s. for each cubicle. Mr. E. A. Mitchell, Engineer to the National Wiring Company, said the wiring was carried out according to specification. The earthing was, he thought, sufficient to prevent fire; and this was the principal consideration taken into account. Mr. Ram stated that the system, save for the defect that the pipes were not earthed, was a perfectly safe one. The conditions were exceptional. He considered that in every public building the switches and fittings ought not to be within reach of the public. If continuous tubing had been used, and the tubes earthed, there would have been no accident. After a short absence, the Jury returned a verdict that death was due to syncope, caused by an electric shock, owing to the faulty design and construction of the electric lighting installation; adding that they were unable to say on whom blame rested.

COAL TAR PRODUCTS IN THE PAST YEAR.

The year 1902 does not leave much room for regrets, as some of its predecessors have done. If certain articles stood painfully still and others fell in prices during the twelve months, the majority have recovered, if they have not actually improved their position.

Pitch may justly be taken as affording the sensation of the year From start to finish there was an unbroken record of advancing prices, and the year was about 22s. per ton better. January began at 38s. 6d. for east coast value; early in March 41s. was reached, and later

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.		Cubic Feet Daily.
BLACKBURN	1,250,000	YORK	750,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	ROCHESTER	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	KINGSTON, ONT.	300,000
COLCHESTER	300,000	CRYSTAL PALACE DISTRICT	2,000,000
BIRKENHEAD.	2,250,000	DULUTH, MINN.	300,000
SWINDON (New Swindon Gas Co.)	120,000	CATERHAM	150,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	LEICESTER	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	ENSCHEDE (HOLLAND)	150,000
HALIFAX	1,000,000	BUENOS AYRES (RIVER PLATE CO.)	700,000
TORONTO	250,000	BURNLEY	1,500,000
OTTAWA.	250,000	KINGSTON-ON-THAMES	1,750,000
LINDSAY (Remodelled)	125,000	ACCRINGTON	500,000
MONTREAL	500,000	TONBRIDGE	300,000
TORONTO (Second Contract Remodelled)	2,000,000	STRETFORD	500,000
BELLEVILLE.	250,000	OLDBURY	300,000
OTTAWA (Second Contract)	250,000	TODMORDEN	500,000
BRANTFORD (Remodelled)	200,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
ST. CATHERINES (Remodelled)	250,000	YORK (Second Contract)	750,000
KINGSTON, PA.	125,000	ROCHESTER (Second Contract)	500,000
PETERBOROUGH, ONT.	250,000	NEWPORT (MON.)	250,000
WILKESBARRE, PA.	750,000	TOKIO, JAPAN.	1,000,000
ST. CATHERINES (Second Contract)	250,000	PERNAMBUCO (Brazil)	125,000
BUFFALO, N.Y.	2,000,000	MALTON	150,000
WINNIPEG, MAN.	500,000	DULUTH, MINN. (Second Contract)	300,000
COLCHESTER (Second Contract)	300,000	BROCKVILLE (ONT.)	250,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.), 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft. TORONTO (3rd Cont.), 750,000 C. Ft.

41s. 6d.; just prior to June 45s. was attained, and a hardening market soon brought 47s. 6d. in this month, to be followed in July by 50s. and later 52s. 6d. During the next two months there was a lull; and it was not until the close of September that there was any further increase, when 1s. was put on, followed by a sudden rise to 55s. In about three weeks 56s. was the figure; and in November 57s. 6d. became current and held good well into December, when the topmost and final price of 60s. was reached. At or about this price the market closed firm, with sellers displaying every sign of confidence for a market much to their liking during the coming year.

Benzols also afforded a satisfactory account of themselves. Opening the year at 11d. for 90's and 10d. for 50's, February brought 10d. and 9½d. respectively, and 9d. and 8½d. were current ere the close of the month. In March, 50's lost another halfpenny. There was then a slight respite for sellers, until the advent of the summer months brought fears of a further fall. In April, this began by a decline to 8½d. and 7½d. for the respective distillates; and after a quiet May the end of June had seen the fractions passed away, and 8d. and 7d. have represented selling values. For nearly four months there was an unbroken period of absolute stagnation, as it was not until the end of October that the lost halfpenny was picked up again. This, however, was the start of a more promising epoch; 50's getting back to 8½d., to be shortly followed by 90's mending to 9d. From this time prices steadily responded to a strengthening demand; and, rising through 9½d. for 90's, finally closed firm at 10d. to 10½d., while 50's continued to hold firmly to 8½d. with the prospect of a possible rise in the near future.

With regard to naphthas, solvent started at 1s., and crude at 4d. The course of the latter was quite uneventful until August, when it had to suffer a drop of 3/4d., and later to 3/4d. By November it was back at 3/4d. Solvent slipped down to 10d. by March, and managed to remain thereto until July, where, after dropping ½d., it went to the bare 9d. A month later 8½d. was all that could be obtained; and in October 8d. was recorded. During November there was a slight improvement; and the year closed at 9d.—being a loss of 3d. as the result of the market for the year.

Creosote was rather lifeless at first, but gave hope of better things later on. The year opened at 1½d. to 2¼d., according to quality; but in March prices fell to 1½d. to 2d., and did not move again until May, when 1½d. to 2¼d. was recorded. At these prices there was a quiet but steady market till September, when there was a rise to 1¾d. to 2¼d., which held good to the close of the year. Thus there was a slight and welcome improvement.

The past year was a bad one for phenols. Crude started at 1s. 10d., and did fairly well up to March—rising as high as 2s. Settling at 1s. 11½d., it was steady until July. Crystals also kept the pace at 6¼d., which, though lower than in January, was a fair price; 6½d. being current at times. In July, however, came the slump; and there was a sudden drop to 1s. 8d., while crystals went to 5½d. For the next three months, prices hovered round 1s. 8d. and 5⅜d. respectively; but in November 1s. 8½d. was once more procurable for crude, and in December 1s. 9d. was about the closing value, while 6d. might be named for 40 per cent. crystals. Thus prices are lower all round on the year; but the stronger request shown in December promises to help prices to get back to a normal level again.

SULPHATE OF AMMONIA AND NITRATE OF SODA LAST YEAR.

According to a circular just issued by Messrs. Peter R. M'Quie and Son, of Liverpool, nitrate of soda opened steady last year, and quickly improved; maintaining the advance for some time, though collapsing at the end of April. It again commenced recovering in October, and was firm at the close of the year. Sulphate of ammonia also began with a strong tone, and experienced a longer run of prosperity. During the autumn, it showed signs of yielding, and short operators took the field; but their campaign proved a failure. In November a reaction set in, and prices then steadily advanced. There was no accumulation of stock at the close of the year, the demand was active, and the position generally favoured a further improvement. Reporting upon the above-named fertilizers, Messrs. W. Montgomery and Co., of London, state that the past year will stand out pre-eminently as the first, for over a decade, in which the consumption of nitrate suffered a serious decline. For fifteen years the European consumption has regularly increased, until 1,154,000 tons was the registered quantity in 1901, followed last year with only 1,028,000 tons, or a difference of 126,000 tons. The shrinkage in the first half of the year amounted to 146,000 tons, reduced to 126,000 tons for the whole year by the more liberal deliveries during the summer and autumn. Much speculation has been indulged in as to the true reason, or reasons, for so serious an alteration in the course of this great market; and Messrs. Montgomery and Co. consider that it is to be accounted for to a large extent by the serious depression in the sugar market, owing to the impending change resulting from the abolition of bounties and cartels. Refined nitrate was everywhere in active demand during the year; and prices were generally maintained at about 3d. to 4d. per hundredweight over the value of ordinary. The combination of producers to restrict and regulate the supply of nitrate continues. The Committee of Management fixed the total quantity for the year ending the 31st of March next at 1,375,000 tons; and this the producers are experiencing great difficulty in furnishing—the probability being that not more than 1,325,000 tons will be achieved. The total consumption of the world for the past three years has been as follows: In 1900, 1,324,000 tons; in 1901, 1,364,000 tons; and in 1902, 1,265,000 tons. The shipments for the same periods have been: In 1900, 1,429,000 tons; in 1901, 1,238,000 tons; and in 1902, 1,351,000 tons. Mr. Thomson Aikman, jun., in the course of his annual report on the nitrate trade, states that the past year's deliveries of this fertilizer from direct imports into

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consuming countries reached about 105,000 tons from ports in the United Kingdom, about 937,000 tons from Continental ports, about 215,000 tons from United States ports, and about 17,000 tons from direct imports into other countries, or a total of about 1,274,000 tons. The total was 1,375,000 tons in 1901, 1,334,000 tons in 1900, 1,335,000 tons in 1899, 1,195,000 tons in 1898, 1,105,000 tons in 1897, 1,060,000 tons in 1896, 1,015,000 tons in 1895, and 990,000 tons in 1894. The price during the past nine years averaged 10s. in 1894, 8s. 3d. in 1895, 7s. 10d. in 1896 and 1897, 7s. 4½d. in 1898, 7s. 10d. in 1899, 8s. 6d. in 1900, 8s. 8½d. in 1901, and 8s. 11d. last year, with a maximum and minimum during these years of 11s. and 7s. per hundredweight. The spot value is now about 9s. to 9s. 3d. On the subject of sulphate of ammonia, he says: "The price at the beginning of the year was £10 17s. 6d. to £11 per ton, and now it is £12 2s. 6d. to £12 5s. From January to April, £11 to £11 10s. per ton ruled; but in May, with stocks exhausted and a good export demand, as high as £12 17s. 6d. was reached. A reaction to £11 10s. in October has been followed by an advance to the closing figure of £12 2s. 6d. to £12 5s. per ton."

METROPOLITAN WATER BOARD.

Constitution of the Board.

The King's Printers' copies of the "Act for establishing a Water Board to manage the supply of water to London and certain adjoining districts, for transferring to the Water Board the undertakings of the Metropolitan Water Companies, and for other purposes connected therewith," were issued last Tuesday. The following is the constitution of the Board: London County Council, 14; Common Council of the City of London, 2; City of Westminster, 2; other Metropolitan Boroughs (one each), 27; borough of West Ham, 2; Urban District Councils of East Ham, Leyton, Walthamstow (one each), 3; Urban District Councils of Buckhurst Hill, Chingford, Loughton, Waltham Holy Cross, Wansted, and Woodford (grouped), 1; Urban District Councils of Beckenham, Bromley, Chislehurst, Penge, Bexley, Dartford, Erith, and Foots Cray (grouped), 1; Urban District Councils of Tottenham and Willesden (one each), 2; Urban District Councils of Brentford, Hampton, Hampton Wick, Hanwell, Heston and Isleworth, Sunbury, Teddington, and Twickenham (grouped), 1; Urban District Councils of Edmonton, Enfield, and Southgate (grouped), and of Hornsey and Wood Green (grouped), 2; Borough Council of Ealing and the Urban District Councils of Acton and Chiswick (grouped), 1; Borough Councils of Kingston and the Urban District Councils of East and West Molesey, Esher and the Dittons, Ham, Surbiton, Barnes, the Maldens and Coombe, and Wimbledon (grouped), 1; County Councils of Essex, Hertfordshire, Kent, Middlesex, and Surrey (one each), 5; Conservators of the Thames, 1; Lea Conservancy Board, 1—total, 66. In addition there will be the Chairman and Vice-Chairman, to be elected by the Board. The first members go out of office on June 1, 1907.

DEEP WELL BORINGS.

Mr. W. Whitaker, F.R.S., at the last meeting of the Geological Society, dealt with the subject of well sections in Suffolk, and gave some particulars from the notes respecting 31 new wells which he has accumulated since 1895. A trial boring for the Woodbridge Water Company gave a depth of 133 ft. 9 in. down to eocene beds, and a thickness of crag about twice as much as any before observed in the neighbourhood. The author is not satisfied with any of the explanations which have been suggested. Two borings at Lowestoft show that crag extends to a depth of 240 feet in one case and more than 200 feet in another—confirming estimates of Mr. Harmer and Mr. Clement Reid. In one of these, chalk was reached at 475 feet. Three other wells in the neighbourhood confirm the great depth of the newer tertiary strata. Sections were also given from the following places: Boulge, Hitcham Street, Ipswich (corroborating the evidence of a deep channel filled with drift given by the section at St. Peter's Quay, New Mill), Shotley, Stansfield, and Brettenham Park. The last shows the greatest thickness of drift recorded in the county—viz., 312 feet. Some two years ago, the Wallasey Urban District Council—who supply water not only to Wallasey itself, but also to Seacombe, Liscard, New Brighton, and Egremont, with a total population approaching 60,000 inhabitants—found it necessary to augment their sources of supply. They accordingly, in July, 1900, placed a contract with Messrs. Mather and Platt, Limited, for two deep boreholes, which were successfully completed by June, 1901. Each starts with a diameter of 33 inches at the top, and finishes with 15½ inches at the bottom, which in one case is 903 feet, and in the other 810 feet from the surface. The 903 feet were bored in 110 working days, giving an average rate of sinking of 8·2 feet per day; the bore being almost entirely through red sandstone rock. These two holes yield 2¼ million gallons per day; but to serve as a stand-by, the Council have determined to carry to greater depths an existing well, 12 feet in diameter and 166 feet deep, in which two pumps are at work side by side. For this purpose, another contract has been placed with the above-named firm for two new holes, to commence at the bottom of the well, and both to be carried down for 150 feet with a diameter of 42½ inches. Here, at a depth of 316 feet, one borehole will stop; but the other will be continued 300 feet, with a diameter of 20 inches, and yet another 200 feet with a diameter of 15 inches, making a total depth of 650 feet from the well bottom, or 816 feet from the ground level. A feature of the contract is that only one of the pumps in the well is to be stopped at a time; and special arrangements have therefore been made to secure the continuous availability of the other during the boring operations.

The Tipton Urban District Council have decided to charge 1s. per quarter for prepayment meters in cases where the gas consumed through them does not amount to 5s. per quarter.

STATION METERS.

DRY METERS.

WET METERS.

SLOT METERS.

WILLEY & CO., LONDON & EXETER.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

There is pending in the Court of Session an action by the Corporation of Dundee, as representing the Town Council, the Gas Commissioners, and the Water Commissioners, against the Caledon Shipbuilding and Engineering Company, of Dundee, in which the question is raised as to the liability of manufacturers to make good damage caused to streets by the carriage of heavy goods. The Caledon Company recently engined the largest vessel which has ever been built in Dundee. Their works are a considerable distance from the docks; and it is said that the conveyance of boilers weighing as much as 105 tons did damage to the surface of the roadways and to the gas and water pipes in them. The pursuers sue for £1000. The defenders say that they and their predecessors have been in the habit of building heavier machinery and taking it through the streets; and that therefore the traffic is neither extraordinary nor exceptional. They further maintain that whatever damage was done was due to the faulty construction of the roads. It is probable that the action will be settled out of Court. On Monday last, Mr. A. Yuill, the Gas Engineer and Manager, reported to the Gas Committee that another firm of manufacturers had taken a boiler, drawn by a traction-engine, through the streets, and that, in consequence, a 6-inch gas-main in South Union Street had been broken, entailing a loss upon the undertaking of £15 9s. 10d. The Committee instructed the Clerk to apply for payment of this amount.

The Gas and Electric Lighting Committee of the Aberdeen Town Council have prepared a report with reference to an agreement, dated July, 1897, entered into between the North British Chemical Syndicate, Limited, and the Town Council, in connection with the erection at the gas-works, by the Syndicate, of plant for the production of crude ferrocyanide of sodium cake, and the minutes of Council, dated April, 1900. The Committee have now to report that a claim on behalf of the Council for goods sold was duly lodged with the Liquidator, the amount being £620; and that, after negotiations, an arrangement has been made for the settlement of all questions between the parties, on the following terms: (1) The Town Council to withdraw and discharge their claim; (2) the Liquidator to renounce and sell to the Town Council his whole right, title, and interest in and to the plant; (3) the Town Council to pay to the Liquidator the sum of £50. The Committee recommend that the Council should confirm the arrangement, and authorize the execution of the minute of agreement to carry it into effect.

In the First Division of the Court of Session this week, the trial took place of the action to which I formerly called attention, as being the only claim for accidental damages arising in the course of the erection of the new gas-works at Granton. The pursuer was Michael O'Neil, a labourer; and the defenders were Messrs. Graham, Morton, and Co., of Leeds, who were the contractors for the retort-house work. The damages asked—£250 at common law, or £200 under the Employers' Liability Act—were in respect of injuries sustained by a fall while walking on a gangway composed of a single plank, and which was not secured at both ends. The defenders said that the pursuer exaggerated his injuries; and that they had made him an offer under the Workmen's Compensation Act. The Jury awarded the pursuer £110 at common law.

A case of gas poisoning occurred in Aberdeen the other night, which goes to show how very slowly wisdom permeates communities where interest is wanting. A farmer engaged a bed-room in a hotel; and, not knowing better, he blew out the gas before retiring. In the morning, he was found in an unconscious condition. He was taken to the Royal Infirmary, where he fortunately recovered under treatment, and was able to go home.

It is reported that the Notkin Light and Power Company, of Edinburgh, have introduced an installation of their gas into the Mansion House of Arlingland, in Dumfriesshire; this being the first practical application of the Company's gas. In this installation, the gas is put under pressure by means of water. A light of from 50 to 100 candles is produced; and if more pressure were available, as much as 300 candles could be obtained.

In a very well-informed article, reviewing the Scottish oil trade for the past year, which was published in the "Scotsman" on the 26th ult., the following passage occurs, which may be of interest to gas managers: "Gas oil has been the worst feature during the year. A very few years ago, the only oil available for gas making in this country was that made by the Scottish oil companies. Now, however, enormous quantities of foreign oil in a crude state are brought into the country. While this has brought down the price to a very low level, it has also created new conditions which are bound before long to have a strong bearing on the price. Not only has the demand for gas making been stimulated, but a demand has been created for this oil for use as fuel. Within the last few years, tremendous strides have been made in America and elsewhere with the use of oil as fuel for steam-boilers. In San Francisco alone, there are at present over 300 steam-boilers burning oil daily. Many of the American railroads burn oil; and in the State of California it is anticipated that in the coming year no less than 8,000,000 barrels of oil will be used by the railroad companies, who are preparing for the exclusive use of oil by placing oil-tanks along the whole line wherever there is now a coal-bunker. On the Southern Pacific Railroad, where oil has been largely used for several years, careful tests have shown that there is a saving of 30 per cent. in the running of trains with oil as motive power. Some of the English railway companies have recently been experimenting in this direction, but it is not yet known what conclusions they have come to. The Admiralty, too, have been making experiments on land; and these have apparently warranted further trials at sea, for we learn that it has been decided to fit up apparatus for burning liquid fuel on H.M. battleships *Hannibal* and *Mars*, and on the cruisers *Bedford* and *Arrogant*. Under these circumstances, steadier markets and higher prices are to be looked for in the near future."

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The annual report by the Directors of the Clippens Oil Company, Limited, is ominous reading for the communities who are subject to rating by the Edinburgh and District Water Trust, between whom and the Company there has been bitterly contested litigation. The report brings out a debit at the balance of profit and loss account of £5389. It proceeds: "The Directors have to report that by a unanimous judgment of the House of Lords, on Aug. 5 last, in the Company's favour, the Edinburgh and District Water Trustees were ordered to implement the award by the Oversman on Nov. 3, 1898, in the arbitration to determine the value of the minerals scheduled under the Water-Works Clauses Act, 1847. The amounts, with interest and expenses, have since been paid as follows: Arbitration award, £10,329; legal expenses recovered from the Water Trustees, £1218 4s. 1d.; interest on sum awarded, £1396 11s.—£12,943 15s. 1d. This ends what was the original question between the Company and the Water Trust—viz., Are the Water Trust to pay for minerals required for the support of their pipes. The Water Trustees attempted to take the Company's minerals for nothing (as the Lord President of the Court of Session said on February 3, 1898. 'The claim of the Trustees is, therefore, that the workings of the Company shall cease without compensation.' The Water Trustees have acted in the most arbitrary manner in their endeavour to appropriate the Company's property. By the suppression of a notice in 1877, given in terms of the Water-Works Clauses Act, 1847, they succeeded in obtaining interim interdict only on coming under an obligation to meet all loss and damage caused to the Company thereby, in the event of the interdict being found illegal. As the shareholders are aware, the interdict was afterwards found to be illegal. It is believed that the action of the Water Trustees has already cost the ratepayers of Edinburgh and Leith about £150,000; and they have now to face the claim for loss and damage caused by the illegal interdict, which involved the shutting down of the works and the destruction of a business of thirty years' standing, in the development of which over £400,000 had been spent. On May 27, 1898, the then Lord Provost, Mr. Mitchell Thomson (now Sir Mitchell Thomson, Bart.), is reported to have stated: 'The Clippens Oil Company had, without doubt, endeavoured to blackmail the Water Trust, and . . . that in a short time a statement would be made.' He has never made his promised statement, nor has he had the courtesy to apologize for his unwarrantable language. Had he and the Water Trustees carried out the honourable understanding come to at a meeting with the Directors specially held at his request, and not attempted to avoid liability by permanently ruining the Company, the four years' litigation and expense would have been obviated, and the citizens of Edinburgh would not now have to meet such an enormous claim for damages, the proceedings in regard to which will be pushed on with as little delay as possible." The meeting of shareholders to consider this report was held in private. The report was adopted.

Statistics were published yesterday regarding the rainfall during 1902 in the gathering-grounds of the Dundee Corporation Water-Works. These are too detailed to be given here. They show variations, in ten places of observation, from 26·45 inches to 42·20 inches, as compared with rainfalls, at those two particular places, in 1901, of 26·73 inches and 31·40 inches respectively. At Monikie, rain fell on 163 days in 1902; and the maximum fall in 24 hours was 1·23 inches, on July 27, which was a most tempestuous day. At Lintrathen, rain fell on 192 days; and the maximum fall was 1·19 inches, on Nov. 29. The maximum monthly fall of rain at Monikie was 3·45 inches, in November; and the maximum monthly fall at Lintrathen was 5·50 inches, in December. The average annual rainfall at Hillhead during the past thirty years was 37·15 inches.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 3.

Sulphate of Ammonia.

There has been good demand at all points throughout the week, and there has been a further improvement in values, more especially on the East Coast, the closing quotations being £12 1s. 3d. per ton f.o.b. Hull, £12 2s. 6d. to £12 3s. 9d. per ton f.o.b. Liverpool, and £12 5s. per ton f.o.b. Leith. Buying has again been mainly for covering purposes; and it is probable that some December contracts have been brought forward into January. There has been a certain amount of direct-buying, but for the most part consumers' views have been below current prices. For delivery ahead no important business has transpired, and it is doubtful whether anything has actually been done; makers now requiring £12 7s. 6d. per ton, ordinary terms, f.o.b. Leith, for January-June delivery, while London is quoted £12 7s. 6d. per ton, Beckton terms, for January-April.

Nitrate of Soda.

This is firm at 9s. per cwt. for ordinary quality, and 9s. 3d. for refined on the spot.

LONDON, *Jan.* 3.

Tar Products.

The markets remain in about the same position. Owing to the holidays, there is very little business doing. Crude carbolic is very dull; and consumers appear to be holding off the market, evidently believing in lower prices. Sales are reported at 1s. 7d. and 1s. 7¼d. for 60's January-February; and there is certainly more offering for both prompt and forward delivery. The position of crystals remains unchanged. There is a little demand for 34-35's; but 39-40's appear to be neglected. Pitch is very firm indeed, especially for early delivery from London, there being a great advantage as regards freight from this port as compared with the north of England. In benzol, there is really no business to report. There appears to be more 50-90 per cent. offering; but there is a fairly good inquiry for 90 per cent. for January-June delivery. Solvent, toluol, and anthracene remain unchanged.

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There is no business doing in any of these articles at present. In creosote, there is nothing of any importance to report. There are one or two large railway contracts at present open; and when these are decided prices may improve, especially in the north of England.

The average values during the week were: Tar, 21s. 6d. to 26s. 6d. Pitch, London, 58s. to 59s.; east coast, 55s. 6d. to 56s.; west coast, 54s. 6d. to 55s. 6d. Benzol, 90 per cent., 10d.; 50-90 per cent., 8¼d. to 8½d. Toluol, 7½d. to 8d. Crude naphtha, 3¼d.; solvent naphtha, 8½d. to 9½d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¾d.; North, 1⅝d to 1½d. Heavy oils, 2d. to 2¼d. Carbolic acid, 60 per cent., 1s. 7d. Naphthalene, 35s. to 55s.; salts, 25s. to 27s. 6d Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market continues firm; and the demand for forward delivery is very strong. The Gaslight and Coke Company are reported to have declined £12 5s., and now quote £12 7s. 6d. for January-April; but even at this price they will offer only a limited quantity. Another large London Gas Company have declined £12 3s. 9d.; but are sellers at £12 5s. for January only. In Leith, makers ask £12 5s., £12 2s. 6d. and £12 3s. 9d. having been paid in several instances. As regards Hull, there are buyers at from £12 1s. 3d. to £12 2s. 6d. for January shipment, and there is also a good inquiry forward; but makers do not care to offer under £12 5s. In Liverpool, there is no business of importance to report. The market remains steady at from £12 1s. 3d. to £12 2s. 6d.

COAL TRADE REPORTS.

Lancashire Coal Trade.

With collieries in this district all stopped for the present over the New Year holidays, extending in most cases from Wednesday last until to-day (Tuesday) before full operations are likely to be resumed, there is practically little to report with regard to the coal trade of Lancashire. Prior to the stoppages, there was no very pressing demand for any description of fuel, with supplies all round in most cases ample to meet requirements. Prices generally were being steadily maintained on the basis of 15s. 6d. to 16s. per ton for best house-fire coals, 13s. 6d. to 14s. for seconds, 10s. 6d. to 11s. 6d. for common, 8s. 6d. to 9s. for steam and forge coals, 6s. 6d. to 7s. for best slack, 5s. 3d. to 5s. 9d. for medium slack, and 4s. 3d. to 4s. 9d. for common sorts at the pit. There were reports of some moderately large inquiries for shipment, which it was supposed were on American accounts. So far, however, there has been no really important renewal export business to the United States; but where inquiries were known to be on American accounts, advances of about 1s. per ton on current rates were quoted. For coke an active inquiry continues to be reported, with a hardening in prices where new contracts are quoted for.

Northern Coal Trade.

There is now a very full demand for coal of most kinds. The renewal of the inquiry from the United States has given a stimulus to the steam-coal trade that is unusual at this time of the year; and prices are very firm. Best Northumbrian steam coals are rather scarce for prompt delivery, at about 11s. 6d. per ton f.o.b. Second-class steams are from 10s. 9d. to 11s. 3d., and steam smalls are about 5s. 6d. The collieries are now working well; and the production should be heavy. In the Durham coal trade, the bright weather limits the use of some kinds of coal; but the demand is full generally. Gas coals are now at the time of the greatest pressure in the demand; and any contracts now made are at about the same prices as those that have expired. For occasional cargoes of best Durham coals, from 9s. 9d. to 10s. per ton f.o.b. is asked; but quantities are not very plentiful, the bulk of the output being taken by the contract deliveries. Gas coke is in fair demand, though the quotations are a little more irregular.

Scotch Coal Trade.

Trade is greatly in abeyance, it being holiday week in Scotland. The shipments reported amounted to 215,051 tons—a decrease of 18,828 tons upon the previous week, but an increase of 57 tons upon the corresponding week of last year. For the year to Saturday, the 27th ult., the total shipments amounted to 11,395,361 tons—an increase of 1,517,272 tons upon the corresponding period of 1901.

Waste Prevention and Water Supply in New York.—The Commission of Engineers recently appointed to investigate the problems of water waste prevention and additional water supply for New York City have entered upon their duties; and they are expected to make their final report by November next. In order to defray their expenses, an appropriation of $100,000 has been made, of which $36,000 is for salaries of the members of the Commission. The Department of Water Supply, Gas, and Electricity will co-operate in the work.

An Explosion at Wandsworth.—An alarming explosion of gas occurred in what is known as Wandsworth Plain last Wednesday. It appears that, under the pathway which skirts the grounds of the Parish Church, is a large, old, disused barrel drain. On Wednesday morning a number of the workmen employed by the Borough Council were repairing the footway under which the drain runs, when suddenly a loud explosion was heard. Several yards of the pathway were upheaved, and the granite kerbstones were flung in various directions. The force of the explosion was very great; and the workmen engaged on the repair were severely shaken, one sustaining a fractured rib. A lamp-post near the spot where the explosion occurred, was torn from its setting and wrecked. It is impossible to state with accuracy what caused the explosion; but it is conjectured that a quantity of sewer gas had accumulated in the old drain referred to, and that a spark from the pick of one of the workmen ignited it, with the result already described. The Gas Company's pipes have been stripped, and were found intact.

BRADDOCK'S PATENT PENNY-IN-THE-SLOT

(ALSO SHILLING-IN-THE-SLOT)

PREPAYMENT WET AND DRY GAS-METERS

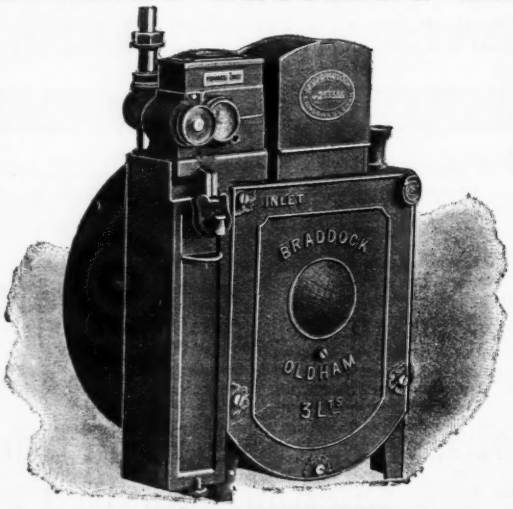
STRONG. DURABLE. SIMPLE. ACCURATE.

POSITIVE GEARING ENSURING RELIABILITY.

The Attachment is kept as distinct from the Meter as possible, and does not interfere with the ordinary Index of the Meter.

METER REPAIRS ARE NOT COMPLICATED.

NO DELICATE PARTS.



No. 222. BRADDOCK'S CAST-IRON CASE WET PREPAYMENT METER.

By the patent arrangement of Crown Change Wheel and fixed long Pinion, the price may be very readily altered *in situ*.

Any number of Feet per Penny may be allowed.

MOST CONVENIENT AND DEFINITE SYSTEM.

NO FINE WHEELS.

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Telegrams: "BRADDOCK, OLDHAM." National Telephone No. 254.

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON S.E.

Telegrams: "METRIQUE, LONDON." Telephone No. 248 HOP.

Sale of the Bottesford Gas-Works.—Our readers may remember that some weeks ago offers were invited for the gas-works at Bottesford, in Nottinghamshire, which were owned by the late Mr. Chester. We learn that a sale has been effected; the purchaser being Mr. Owens, of Barrow-in-Furness.

The New Water-Works for Margate.—The Margate Town Council have received tenders for the erection of the pumping-station at Uffington, near Wingham, in connection with their new water scheme. They ranged from £9454 down to £6986. The latter was the figure submitted by Mr. G. Browning, of Canterbury; and the Council have accepted it.

Gas Workers' Wages at Colne.—A breezy discussion took place at the monthly meeting of the Colne Town Council last Wednesday, on a motion submitted by Mr. Paterson to the effect that the coal and coke wheelers at the gas-works should be paid at the rate of 4s. 6d. per shift of eight hours. The Gas Committee were opposed to the change; and in the end the motion was rejected.

Sheppey Water Supply.—A Company was recently formed for the purpose of supplying the Isle of Sheppey with water; and the foundation stone of the works was laid on Monday of last week by the Chairman (Mr. F. F. Ramuz), who was presented with a silver trowel as a memento of the occasion. At the invitation of the Directors, those present at the ceremony subsequently lunched together.

Water-Works for Whittle-le-Woods and District.—Water-works for the townships of Whittle-le-Woods, Clayton, Heapey, and Wheelton were recently completed at a cost of £8600; and on Monday afternoon last week the ceremony of turning on the water was performed by Mr. J. N. Boothman, a member of the Chorley Rural District Council. The reservoir has been constructed at Heapey, and the water is obtained from the Thirlmere aqueduct.

Discount on Slot-Meter Receipts.—A new departure is to be taken by the Plymouth and Stonehouse Gas Company. With the object of encouraging a fuller use of the burners and stoves provided, the Company announce that a discount will be allowed to all consumers of 1000 cubic feet or more of gas per month. This allowance will be made at the time the contents of the meter-boxes are collected. Where the consumption reaches the limit prescribed, the collectors will return to the consumers 1d. out of each 10d. collected. The price to slot consumers in Plymouth is 1d. for 25 cubic feet, or at the rate of 3s. 4d. per 1000 cubic feet. This discount will reduce the price to certain of the prepayment consumers to 3s.

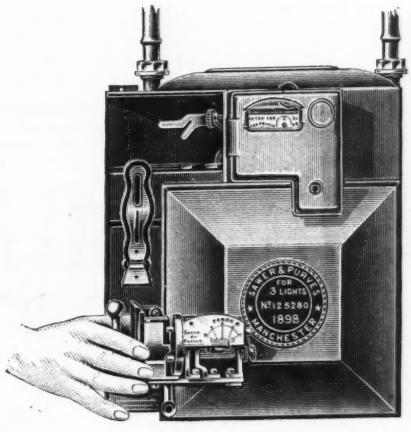
Bilston Gas Company.—At the annual meeting of this Company yesterday, the accounts presented for the year ending the 30th of September showed that the receipts from the sale of gas were £18,859, and that the total revenue was £27,516. The expenditure being £22,024, there was a balance of £5492 to go to the profit and loss account. After paying the usual interim dividend, there was a balance of £3694, out of which dividends of 5s. 6d. and 4s. per share on the "A" and "B" shares respectively (making 11s. and 8s. for the year) were declared; leaving a balance of £1009 to be carried to next year's accounts. The Engineer and Secretary (Mr. J. S. Reeves) reported that the works had been maintained in a state of efficiency.

Electrical Thawing of Frozen Water-Pipes.—The "Electrical World" says that the electrical thawing of frozen water-pipes has been a regular winter business at Sault Ste. Marie for the last six years. The essentials of the equipment are a horse, a sleigh, and a 60 kilowatt transformer. The high-tension mains are bared, and an emergency connection is made for the primary. The secondary is connected to the iron pipe to be thawed out. The terms are (usually) 12s. a thaw, and pay when the water runs. The job may be over in a minute; but a 4-inch pipe frozen more or less for 200 feet has taken half an hour. The apparatus is said to never fail; and the fact that none of the men who handle the 2200-volt temporary connections have succeeded in hurting or killing themselves is ascribed to the circumstance that all possible earths are covered with a most excellent insulator in the shape of cold dry snow.

Award in the Overwater Arbitration.—Early in October last, arbitration proceedings took place in Carlisle in connection with a claim made by Miss Mary A. Gough against the Aspatria, Silloth, and District Joint Water Board for compensation for the land and other rights acquired from her by the Board for carrying out their scheme for supplying the district from Overwater. On behalf of the claimant, sums ranging from £11,548 to £13,076 were named; the figures submitted by the other side varying from £495 to £1967. Sir Ralph Littler, K.C., appeared for Miss Gough; Mr. Balfour Browne, K.C., for the Board. The Umpire was Mr. R. E. Middleton, M.Inst.C.E., whose award has just been published in the form of a special case stated for the opinion of the King's Bench Division. Various legal points arose in the course of the proceedings, and if these are decided in the claimant's favour, the total sum awarded to her will be £8974. All the costs incidental to the arbitration, as well as the Umpire's fee, have to be borne by the Board.

Gas-Works Inspection and Testing Experiments at Southport.—Last Tuesday, the members of the Lighting Committee of the Birkdale Urban District Council visited the Crowlands Gas-Works, Southport, where they were received by Mr. E. Trounson (Deputy-Mayor and Chairman of the Gas Committee) and the members of the Gas Committee. They proceeded to inspect the works, and experiments were made with a new table photometer which will in future be used for all the gas tests. The Birkdale authorities have, in accordance with the agreement come to, installed an exactly similar appliance at the Birkdale Town Hall, and in future the tests in the two townships, though independently conducted, will be made with the same instruments. This should lessen the friction which has sometimes arisen. With regard to the reduction in the illuminating power of the gas to 16 candles, and the adoption of a uniform price of 2s. 8d. per 1000 cubic feet after the 1st inst., it is satisfactory, especially to consumers of gas for power and heating purposes, that the Committee are paying special attention to the heating quality of the gas. Its calorific power is now taken regularly, and is reported to the Committee in their weekly sheets.

THE POSITIVE PREPAYMENT



IS PRE-EMINENT.

PRODUCED BY

SAWER & PURVES,

MANCHESTER.

Wellington (Salop) District Council and the Gas-Works.—At a special meeting held last Wednesday, the Wellington (Salop) Urban District Council decided to promote a Bill to provide for the transfer to them of the undertaking of the Wellington Gas Company, and for the supply of gas by the Council. They also resolved to oppose the Bill which the Company are promoting.

Fire at the Wedding Gas-Works in Berlin.—A big fire broke out at the Berlin Municipal Gas-Works in the Müllerstrasse (Wedding) on the 10th ult., which completely destroyed one of the two large purifying-houses there, and slightly damaged the other. The houses were each 262 feet long and 82 feet wide, and comprised three floors. The fire arose from the spontaneous ignition of foul oxide at about 6.15 a.m.; and it was extinguished about 9 a.m.

Southport Water Charges.—The question of the scale of charges for large consumers of water has been under consideration by the Southport, Birkdale, and West Lancashire Joint Water Board. Inquiries have been made with regard to the charges with respect to large consumers in at least 20 other towns, including Liverpool, Blackburn, Blackpool, &c., and in only one case was it found that there was a lower charge than at Southport. At present, 9d. per 1000 gallons is charged for water supplied in excess of 1½ million gallons, and 6d. when the quantity is in excess of 2 million gallons. On going into the question, it was found that it was impossible to sell water at this figure, and that a loss was being entailed. Accordingly, the minimum charge was fixed at 9d. per 1000 gallons for any quantity over 1½ million gallons. The only exception to this rule will be the Corporation, who will still get all the water they require for public health purposes at the 6d. rate. The number of consumers who will be affected by the new charges is very small—in fact, so far as can be ascertained, the only parties will be the Corporation and the two Railway Companies.

Selby Gas Supply.—Last Tuesday, Major C. E. Norton, R.E., a Local Government Board Inspector, held an inquiry at Selby relative to the application of the Urban District Council for power to borrow £3000 for gas-works purposes. It was stated that the present loan was sought on account of a surcharge which had been made by the Auditor. The revenue of the works was not sufficient to pay the expenses. The Inspector asked why the Council did not before apply for a loan, as it was contrary to the practice of the Board to grant a loan for works for which they had given no sanction at all. Mr. Scott said practically the Council had had a loan from the bank, which the Auditor had disallowed. The Inspector alluded to the somewhat irregular course pursued in reference to the matter, and remarked that it was impossible for him to say whether or not the Board would sanction the loan. Mr. Scott said the mischief had been done by the Auditor. If he had checked the Council years ago, they would not have carried on in that way. The repayment of the loan for the purchase of the gas-works had been made out of the profits. The ratepayers had never been called upon to pay a penny for them.

British Coal for the United States.—Some friction has arisen between the Board appointed to arbitrate on the recent coal strike in the United States and the representatives of the Miners' Union, and as a result, says Reuter's Liverpool correspondent, 150,000 to 200,000 tons of coal of various English, Welsh, and Scotch descriptions have been contracted for for shipment from the United Kingdom to Philadelphia, New York, Boston, Portland (Maine), and other United States ports. The actual shipment of the coal commenced some days ago, and it is expected to continue for the next three or four weeks. Altogether about 40 steamers of various tonnage have been chartered for the purpose—the ports of shipment being Hull, Liverpool, Cardiff, the Clyde, and the Tyne; and the engagement of further steamers is in progress.

Messrs. F. C. Sugden and Co., of Leeds, have had placed with them, by the Mablethorpe and Sutton Gas Company, Limited, an order for a new retort-bench complete with all ironwork; the settings being of their shallow regenerator type.

Messrs. Clapham Bros., Limited, of Keighley, have had placed with them the order for the cast iron and steel work for six through benches of retorts, stage flooring, and rails in connection with the retort-house extensions for the Bury Corporation.

During a storm which prevailed on the night of Sunday, the 28th ult., the framing to the holder at the Overton Gas-Works was injured, and 12,000 cubic feet of gas escaped. Mr. Hollier, the Manager, however, by taking prompt measures, was enabled to prevent the village from being in darkness.

The Witton Fire-Brick Company, Limited, has been registered with a capital of £7000, in £5 shares, to adopt an agreement with the Witton Fire-Brick Company, and to carry on business as colliery mine owners, coke and lime burners, and quarry and brick makers, fire-clay manufacturers, &c. There is no initial public issue.

Messrs. W. J. Jenkins and Co., Limited, of Retford, have just received a repeat order from the Bury (Lancs.) Corporation for two De Brouwer patent hot-coke conveyors. The first De Brouwer conveyors at these works were started fifteen months ago; and as they have worked continuously for this time with great saving and success, the Engineer (Mr. Henry Simmonds) has recommended his Committee to put in this second installation.

As may have been noticed from our advertisement columns, the Tottenham and Edmonton Gas Company are inviting tenders for £7500 of 4 per cent. perpetual debenture stock. Hitherto, the bulk of the Company's capital has been subscribed by investors who are not resident in the district. It is now intended to afford special facilities to the residents and consumers to acquire an interest in the Company; and accordingly tenders may be sent in for portions of stock down to as low as £20. The minimum price is £102 per cent.; and the last day for tendering is the 19th inst.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

SITUATIONS VACANT.

BLACKSMITH AND FITTER. Worthing Gas Company.
DISTRICT SUPERINTENDENT. No. 3971.
DRAUGHTSMAN. Ramsgate Gas and Water Department. Jan. 17.
GAS-FITTER AND BLACKSMITH. Waltham Cross Gas-Works.
GENERAL FOREMAN. No. 3970.
ENGINEER AND MANAGER. Reading Gas Company. Jan. 12.
ENGINEER. Sheffield Water Department. Jan. 26.
ENGINEERING ASSISTANT (Water-Works). No. 3965.
MAIN INSPECTOR. Colne Valley Water Company.
STOKER. Oakham Gas-Works.

SITUATIONS WANTED.

ASSISTANT TO GAS ENGINEER. No. 3966.
GAS MANAGER OR SUPERINTENDENT. No. 3967.
MAIN AND SERVICE LAYER OR FITTER. No. 3969.
RENTAL CLERK. No. 3968.
TRAVELLER IN GAS STOVE TRADE. Howland, Faversham.

GAS ESCAPE INDICATOR FOR SALE (Patent). Medd, Twickenham.

GAS-WORKS TO LET. Burton, *via* Carnforth.

PLANT, &c. (Second-Hand), FOR SALE.

PURIFIERS AND CONNECTIONS. Wright, London.
PURIFIERS, SCRUBBER-WASHERS, GASHOLDERS, &c. Firth Blakeley, Dewsbury.
STATION GOVERNOR. Lancaster Gas-Works.
STATION METER. (30,000 cubic feet.) Lancaster Gas-Works.

PLANT, &c. (Second-Hand), WANTED.

METERS (DISUSED), BRASS, COPPER, LEAD ASHES, &c. Smith, Bradford.

SALES OF STOCKS AND SHARES.

BARNET GAS AND WATER COMPANY. Jan. 13.
BRIGHTON AND HOVE GAS COMPANY. Jan. 13.
GUILDFORD GAS COMPANY. Jan. 13.
KINGSTON-ON-THAMES GAS COMPANY. Jan. 13.
NEW RIVER COMPANY. Jan. 15.
NEWCASTLE AND GATESHEAD WATER COMPANY. Jan. 20.
SOUTH METROPOLITAN GAS COMPANY.
SHREWSBURY GAS COMPANY. Jan. 30.

TENDERS FOR

COAL.

COPENHAGEN. 100,000 tons. Tenders by Jan. 19.

LIGHTING (Gas or Electricity).

GUAYAQUIL. Equadorian Consulate at Liverpool or Southampton.

PIPES AND CONNECTIONS, &c.

DERBY WATER DEPARTMENT. Tenders by Jan. 17.
LEICESTER GAS DEPARTMENT. Tenders by Jan. 3.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

One Year, 21s.; Half Year, 10s. 6d.; Quarter, 6s. 6d.

Payable in Advance. If credit is taken, the charge is 25s. a year.

Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year, 1903, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale than all other Oxides combined. Purity and uniformity of quality guaranteed.

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ANDREW STEPHENSON, AGENT. All communications RE OXIDE to the COMPANY as above.

WINKELMANN'S

"VOLCANIC" FIRE CEMENT.

Resists 4500° Fahr. Best for GAS-WORKS.

ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

IT is worth your while to buy direct. THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Subastral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

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BROTHERTON AND CO., LTD., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

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HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

PATENTS AND TRADE MARKS PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.

MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., LTD., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

MR. S. J. HOWLAND, late with Messrs. John Wright and Eagle Range, Limited, desires position as TRAVELLER. Good References.

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For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

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H. GREENE & SONS, Ltd., are pre- pared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.

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Telegrams: "LUMINOSITY."

GAS Manager seeks re-engagement having Eight Years' Experience as Assistant and General Manager on Gas-Works. Has practical knowledge of modern Methods of Manufacture, Purification, and Distribution of Gas (both Coal and Carburetted Water Gas); also the Manufacture of Sulphate of Ammonia. Careful and attentive to duties. Would accept position as Manager and Secretary on Small Works, or Superintendent or General Foreman on large Works. Age 31. Married. Excellent Testimonials and References.

Address No. 3967, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

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First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses:
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General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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F. A. HELPS & SON, have removed from No. 9, Cornhill, E.C., to No. 75, OLD BROAD STREET, LONDON, E.C.

WANTED, a Situation as Main and SERVICE LAYER or GENERAL FITTER. Age 24. Single. Two Years in present Situation.

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RENTAL Clerk (Gas or Water) seeks Situation. Thoroughly experienced and conversant with the keeping of all Books in either Department.

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APPOINTMENT wanted by a Young Man (Age 23) as ASSISTANT to Gas Engineer. Served Articles at Gas-Works. Practical experience of Regenerative Furnaces and Carburetted Water Gas. Fair Draughtsman. Well up in Laboratory Work and Works Accounts. First-class Certificates in Gas Manufacture, Chemistry, and Building Construction. Good Testimonials and References.

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WANTED, at once, a qualified Gas- FITTER and BLACKSMITH combined, used to the routine of a Gas-Works.

Apply to the MANAGER, Gas-Works, WALTHAM CROSS.

OAKHAM GAS-WORKS.

WANTED, a Good, Steady Man as STOKER, used to Shovel Charging and Regenerative Settings.

For Wages and Particulars, apply to the MANAGER, Gas Office, OAKHAM.

WORTHING GAS COMPANY.

WANTED, a thoroughly Handy Man as BLACKSMITH and FITTER.

A Young Man well accustomed to Fitters' Work in the Retort-House and Yard, also to the repair of Tools, and one who is steady and reliable will receive encouragement.

Apply, stating Wages expected, to
W. A. WALKER,
Engineer and Manager.

CITY OF SHEFFIELD.
(WATER DEPARTMENT.)

DERWENT VALLEY WATER ACT, 1899.

THE City Council of Sheffield are about to proceed with the construction of a Tunnel for the purpose of conveying Water from the Works of the Derwent Valley Water Board at Lady Bower to the Works of the Sheffield Corporation in the Rivelin Valley—a total length of nearly Five Miles. The work to be designed and constructed under the charge and direction of an EXPERIENCED ENGINEER, who shall reside in the Rivelin Valley or neighbourhood, and devote the whole of his time to his duties under the Corporation, and who shall have daily personal charge of the work, and be responsible for it throughout, and shall do all special work in connection therewith which the Water Committee may desire, the Staff of Assistants, Inspectors, and others being provided by the Corporation, and under the direction of the Engineer.

The Engineer shall consult with the "Consulting Engineer" with regard to all Plans and Designs, and at every step during the progress of the Works, but without thereby lessening his own absolute responsibility, and he shall report direct to the Water Committee, from whom alone he will take direc ions.

The engagement to be until the completion of the above Works.

APPLICATIONS are hereby invited from COMPETENT ENGINEERS; it being indispensable that Candidates for the appointment should have had considerable experience both in the design and carrying out of similar Works under a Contractor or by administration under a Public Authority.

The application must state Age, Experience, present Position, Salary required, when at liberty, and contain *copies* of Testimonials, and furnish at least two References.

Personal Canvassing will be a disqualification.

Applications to be sent to me not later than Monday, Jan. 26, 1903, endorsed "Rivelin Engineer."

WILLIAM TERREY,
General Manager.

Water-Works Office, Town Hall, Sheffield,
Jan. 3, 1903.

COAL GAS TAR wanted.

Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.

State Quantity to offer for Prompt and Forward Delivery.

The SHARPNESS CHEMICAL COMPANY, Tar Distillers Sharpness Docks, GLOS.

OXIDE OF IRON.

FIRE Cement, Paint, Mains, Tubes, STREET LANTERNS, GLASS, TOOLS, &c.

BALE & CHURCH,
5, CROOKED LANE, CANNON STREET,
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COLNE VALLEY WATER COMPANY.

MAIN Inspector wanted who has been used to the Repair of Water-Mains. Age about 25.

Apply, by letter, to the Secretary of the Company, Bushey, Watford, with Particulars of Experience, References, &c.

Jan. 5, 1903.

DISTRICT SUPERINTENDENT re- quired by a Suburban Gas Company. Must be thoroughly competent to take charge of Distributing Department, and to extend Business. Salary £150.

State Age, Experience, when disengaged, and send *copies* of Testimonials, to No. 3971, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a large Gas Company in the South of England, a GENERAL FOREMAN, who must be used to work in connection with Inclined Retorts, Elevating and Conveying Machinery, the Manufacture of Sulphate of Ammonia, &c. He must be a thoroughly practical man, sober, steady, and thoroughly capable of taking entire charge of the Works in the absence of the Engineer. Wages £2 per week, with Cottage on the Works.

Apply, by letter, to No. 3970, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Water-Works, a Me- chanical Engineering ASSISTANT. £150 per annum. Must have a thorough practical and theoretical knowledge of Engines, and be competent to conduct Engine Trials. Must also be a good Draughtsman. Will be required to prepare Plans for remodelling old Pumping Plant.

Apply, by letter, stating Age (not over 30), whether Married, giving full particulars of Scientific Training and Experience in chronological order and *copies* of Testimonials, to No. 3965, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Engineer of the Ramsgate Cor- poration Gas and Water Works, requires the services of a thoroughly qualified DRAUGHTSMAN. He must be competent to design Buildings and all kinds of Plant and Apparatus connected with the Manufacture, Purification, and Distribution of Gas. He must also be capable of estimating quantities, and perfect in the preparation of detailed drawings. A knowledge of Hydraulics and Levelling would be an additional qualification.

Applications, by letter only, accompanied by *copies* of three recent Testimonials, stating Age, Experience, and Salary required, to be sent, on or before Jan. 17, 1903, addressed to the ENGINEER, Gas and Water Works, RAMSGATE.

READING GAS COMPANY.

GAS ENGINEER AND MANAGER.

THE Directors of the above Company require the services of an experienced GAS ENGINEER and MANAGER.

He must not be less than Thirty nor more than Forty-Five Years of Age, and must have had a thorough practical experience of Gas Manufacture in all its Branches, including the Design and Construction of Modern Gas-Works Plant.

Applications (which will be treated in confidence), stating Salary required, Age, and giving a detailed account of previous Training and Experience, together with *copies* of not more than Four Testimonials, should be sent to me on or before Monday, Jan. 12, 1903, endorsed "Application for Engineer."

Canvassing will disqualify.

By order,
ARTHUR H. CANE,
Secretary.

7, King Street, Reading,
Dec. 9, 1902.

TO BE LET—The Burton Gas-Works for a Term of Years. Possession March 28, 1903. Tenders taken to Jan. 20.

Apply L. H. NUTTER, Burton, *viâ* CARNFORTH.

WANTED, old Disused Gas-Meters, BRASS, COPPER, and LEAD ASHES for Cash.

J. SMITH, Broker, Canal Road, BRADFORD.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.

Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE—A New Patent Gas Escape INDICATOR, to avoid Gas Explosions or Suffocation.

Apply to G. MEDD, 80, Queen's Road, TWICKENHAM.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

FOR SALE.

A 30,000 cubic feet per hour Station METER, with Hydraulic Valves, Bye-Pass, &c., complete, in splendid condition; Drum only a few years old. Also a 15-inch STATION GOVERNOR. Can give immediate delivery of Meter, and early delivery of Governor.
Offers to be sent to
C. ARMITAGE.
Corporation Gas-Works, Lancaster.

TENDERS FOR LIGHTING—GAS OR ELECTRICITY.

THE Municipal Council of Guayaquil, Republic of Ecuador (South America), are desirous of receiving TENDERS for a new INSTALLATION of PUBLIC LIGHTING, the Light to be Gas, Electricity, or both combined. The Municipal Council will pay monthly for a minimum of 1400 ordinary, 15 25-candle power lights, and 50 80-candle power lights to burn eleven hours daily. The whole of the private house lighting will be done by the new installation.
Tenders received not later than the 12th of February, 1903.
Apply for further Information to the ECUADORIAN CONSULATES, at Liverpool. 35, Chapel Walks; or at SOUTHAMPTON, 4, Oriental Place.

TENDERS FOR GAS COAL.

THE Magistracy of Copenhagen are prepared to receive TENDERS for the supply and delivery of 100,000 Tons of best GAS COAL from the beginning of April, 1903, until the end of December, 1903.
The Magistracy reserve the right to divide the Contracts between two or more Contractors.
Further Information and Conditions for the delivery may be obtained on application to Kjöbenhavns-Belysningsvœsen, Vestre-Boulevard, Köbenhavn B.
The Tenders, sealed and marked "Tilbud paa Kul," to be sent to Magistratens, 4de Afdeling. Det nye Raadhus, Köbenhavn B, before the 19th of January, 1903, Twelve o'clock, at which time the Tenders will be opened in the presence of the parties tendering who are in attendance.
THE MAGISTRACY OF COPENHAGEN.
Dec. 23, 1902.

SHREWSBURY GASLIGHT COMPANY.

DESIRABLE INVESTMENT.

THE Directors of the above Company invite TENDERS for sufficient SHREWSBURY GAS CONVERTED ORDINARY STOCK to produce the sum of £14,176.
This Stock is entitled to a Standard Dividend of 5 per cent., payable half-yearly, and the Maximum Dividend has been paid for many Years.
January 30, 1903, is the last day for reception of Tenders.
Forms of Tender may be had on application to LLOYDS BANK, LIMITED, SHREWSBURY, or to the Company's Secretary, from whom any further Information can be obtained.
By order of the Directors,
WM. BELTON,
Secretary.
Gas-Works, Shrewsbury,
Dec. 18, 1902.

CORPORATION OF LEICESTER.

CAST-IRON PIPES.

THE Gas and Electric Lighting Com- mittee of the above Corporation are prepared to receive TENDERS for the supply and delivery of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 36 inches in diameter, required during the Twelve Months ending the 31st of December, 1903.
Specification and Form of Tender may be obtained upon application to the Engineer.
Tenders, addressed to Mr. Councillor Edwards, Chairman, and endorsed "Tender for Cast Iron Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Jan. 10, 1903.
The Committee do not bind themselves to accept the lowest or any Tender.
ALFRED COLSON,
M.Inst. C.E., M.Inst. E.E.
Engineer and Manager.
Offices: Millstone Lane, Leicester,
Jan. 3, 1903.

DERBY CORPORATION WATER-WORKS.

TO PIPEFOUNDERS.

CONTRACT No. 5.

THE Corporation of Derby are pre- pared to receive TENDERS for the Making and Delivery of about three miles in length of Cast-Iron Socket PIPES, 30 inches internal diameter, together with certain OTHER PIPES and SPECIAL CASTINGS.
Specifications and Forms of Tender may be had (on payment of the sum of Two Guineas, to be returned on receipt of a *bonâ-fide* Tender) on application at the Borough Surveyor's Office, Babbington Lane, Derby, or at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Wednesday, the 7th of January inst., and Tenders must be delivered at my Office at or before Ten o'clock in the forenoon of Saturday, the 17th of January, 1903.
The Corporation do not pledge themselves to accept the lowest or any tender.
G. TREVELYAN LEE,
Town Clerk.
Derby, January, 1903.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that the Directors of this Company will OFFER the Sum of £100,000 ORDINARY STOCK to all the Gas Consumers and Persons in the employ of the Company, pursuant to the Provisions of the South Metropolitan Gas Act, 1901.
Full Particulars thereof, together with the price of such Stock, will be sent to the Consumers with the Gas Accounts for the Christmas quarter.
By order,
FRANK BUSH,
Secretary.
Offices: 709, Old Kent Road, S.E.,
Dec. 16, 1902.

NEW RIVER COMPANY.

ISSUE OF £250,000 THREE PER CENT. DEBENTURE STOCK "D."

NOTICE is Hereby Given, that the Directors are prepared to receive TENDERS for the above Issue (being part of the £1,000,000 Debenture Stock "D" authorized by the New River Company's Act, 1897), bearing Interest at Three per Cent. per Annum, and Redeemable at par at any time after the expiration of Twenty-Five Years from the date of issue, upon Six Months' Previous Notice being given by the Company.
Particulars, Conditions of Sale, and Forms of Tender, may be obtained at the Company's Office, Rosebery Avenue, Clerkenwell, E.C.
Sealed Tenders are to be delivered at the New River Office, not later than Ten o'clock a.m. on Thursday, the 15th of January, 1903.
Reserve Price, £97 per cent.
The Stock is a lawful Investment for Trustees.
By order of the New River Company,
JAMES SEARLE,
Clerk.
New River Office, Rosebery Avenue,
Clerkenwell, E.C., December, 1902.

KINGSTON-UPON-THAMES GAS COMPANY.

SALE BY TENDER
OF
£2200
FOUR PER CENT.
PERPETUAL DEBENTURE STOCK.
MINIMUM PRICE £100 PER CENT.

NOTICE is Hereby Given, that it is the intention of the Directors of the above Company to SELL by TENDER £2200 of 4 PER CENT. PERPETUAL DEBENTURE STOCK, in accordance with the Provisions of the Kingston-upon-Thames Gas Act, 1900.
Particulars of same, with Form of Tender, can be obtained on application to the undersigned, and Tenders must be sent in on or before Four o'clock (afternoon) on Tuesday, the 13th day of January, 1903.
The Stock will be allotted to the highest bidders; but no Tender will be accepted at a lower rate than £100 for each £100 Debenture Stock.
By order,
J. A. FRICKER,
Secretary.
Offices: 38, Thames Street,
Kingston-upon-Thames.
Dec. 24, 1902.

NEWCASTLE AND GATESHEAD WATER COMPANY.

SALE OF ORDINARY STOCK.

TO BE SOLD by Auction, in the Board Room of the Company's Offices, Pilgrim Street, Newcastle-on-Tyne, on Tuesday, the 20th of January, 1903, at Half-past Twelve o'clock precisely, by Mr. CHARLES A. JOEL, in such Lots as are provided for in the Company's Act of 1898—

SIXTY THOUSAND POUNDS OF ORDINARY STOCK (ACT, 1898). (MAXIMUM DIVIDEND £7 PER CENT. PER ANNUM).

The above Stock is part of the £7 per cent. Maximum Ordinary Stock created under the powers of the Newcastle and Gateshead Water-Works Acts, 1898 and 1902.
The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Stock of the Company is entitled shall not be paid in full, but such diminution may be made up in subsequent Years. The Dividend paid on the Ordinary Stocks of the Company for the past three years has been as follows:—
On the Original Ordinary £10 per cent. Stock, £8 10s. per cent. per annum.
On the Ordinary £7 per cent. Stock, £5 19s. per cent. per annum.
Printed Particulars and Conditions of Sale may be had at the COMPANY'S OFFICES; and Messrs GEORGE ARMSTRONG & SONS, Solicitors, Newcastle-on Tyne; or of the AUCTIONEER, 66, New Bridge Street, Newcastle upon-Tyne.
GEORGE SMITH,
Secretary and General Manager.
Newcastle-on-Tyne,
Dec. 9, 1902.

Just Published, Cloth, 3s. 6d.

DOWDING'S WAGES TABLES

CALCULATED FOR

WAGES PAYABLE BY THE HOUR.

They contain in a straightforward Tabular Form every Amount which can possibly be required at Rates of from 3d. to 1s. per Hour, and from 1 to 72½ Hours. Rising by SUCCESSIVE QUARTERS of an Hour as to Time, and by SUCCESSIVE FARTHINGS as to Money, while Farthings and Halfpennies are entirely eliminated.
Compiled by **EDWIN DOWDING,** *Accountant.*

KING, SELL, & OLDING, LTD., 27, Chancery Lane, W.C.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

BRIGHTON AND HOVE GENERAL GAS COMPANY.

£1560 "ORIGINAL" ORDINARY STOCK AND £1820 "A" ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 13, 1903, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
BARNET DISTRICT GAS AND WATER COMPANY.

NEW ISSUE OF £5000 "D" CAPITAL GAS STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 13, 1903, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
GUILDFORD GASLIGHT AND COKE COMPANY.

NEW ISSUE OF £5000 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Jan. 13, 1903, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ARMSTRONG'S PATENT

CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

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ESTABLISHED 1820.

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MADE from Spent Oxide (free from Arsenic) and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.

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Inquiries Solicited.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

TROTTER, HAINES, & CORBETT, LIMITED,
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Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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THOMAS DUXBURY & CO.,
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Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
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Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

WELDON MUD
FOR
GAS PURIFICATION,
For use in the
RECOVERY OF SULPHUR,
Also Removal of last Traces of
SULPHURETTED HYDROGEN
in catch position.

Full Particulars on application to the Patentees:
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CANNEL COAL MERCHANT,
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Prices and Analysis of all the Scotch Cannels on Application.

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WELLINGTON MILLS
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Asbestos Spinners and Manufacturers.
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If you have any trouble with your BELTS slipping on the Pulleys, or Drying and Cracking, drop us a post card for a **Free Trial Tin** of our
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Ask for No. 6 Catalogue.
Asbestchoucine for Rubber, Gutta, and Balata Belts.

THE PLAISSETTY MANTLE.

This Mantle maintains its full Illuminating Power during the whole of its Life; stands vibration better than any Mantle in the world; and has a normal life of at least 2000 hours. Candle power on "C" Burner, 19 candles per cubic foot.

THE PLAISSETTY MANTLE SYNDICATE, LIMITED, *Registered Offices:* 6, Old Serjeants Inn, Chancery Lane, W.C.

THE HOUSEHOLD GAS HEATER & COOKER (PARENT) COMPANY, LTD.
(ROSS SYSTEM).

Perfect Combustion.
No Smell. Great Heat.

Gas Stoves,
HEATING & COOKING.
Invaluable for Sick Room. No Flues.

LIBERAL DISCOUNTS to the Trade.

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Recommended by the
Medical Profession.

THE KING OF HEATERS.

THE CONSUMPTION OF GAS UNDER ONE FARTHING AN HOUR.

For Particulars apply to the Secretary.

Telegrams—"GASFLAMME, LONDON."

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JAMES MILNE & SON, LTD.,
GAS ENGINEERS
MILTON HOUSE WORKS EDINBURGH.
LONDON. — LEEDS. — GLASGOW.

MOBBERLEY & PERRY
STOURBRIDGE.
Manufacture & supply best quality of
Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)
Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.
FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c, &c.
EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.
Contractors for the erection of Retort-Benches complete.

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Gas Companies are solicited to try Samples of the

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BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
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THE
PIPE UNION CLIP COMPANY.

Sole Manufacturers of the PATENT UNION CLIP, which ensures that all Gas used, passes through the Meter.

Holmes Chapel, Near Crewe.

PRICE
For 2 or 3 light Meters, 60s. per gross.

UNION WITHOUT CLIP.

UNION WITH CLIP FITTED.

THE
"ROTARY"
STATION METER.

Efficiency
Demonstrated.

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THOMAS TURTON
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SHEAF WORKS, SHEFFIELD.
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
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NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
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Operated Entirely by One Handle

Class A lifts 24 ft.
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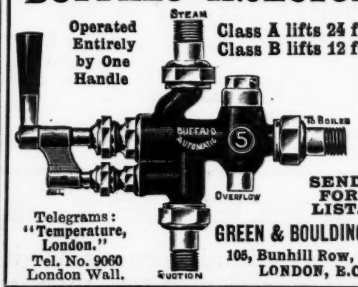

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JOHN HALL & CO.,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.

RETORTS CAREFULLY PACKED
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THE PATENT
"BEACON" GLOBE LAMP.

Largely adopted by many Local Authorities for Public Lighting, being absolutely Shadowless and Wind-proof.

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Late of Cannon Street,
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Telephone: 255 AVENUE. Telegrams: "LUMINOSITY."

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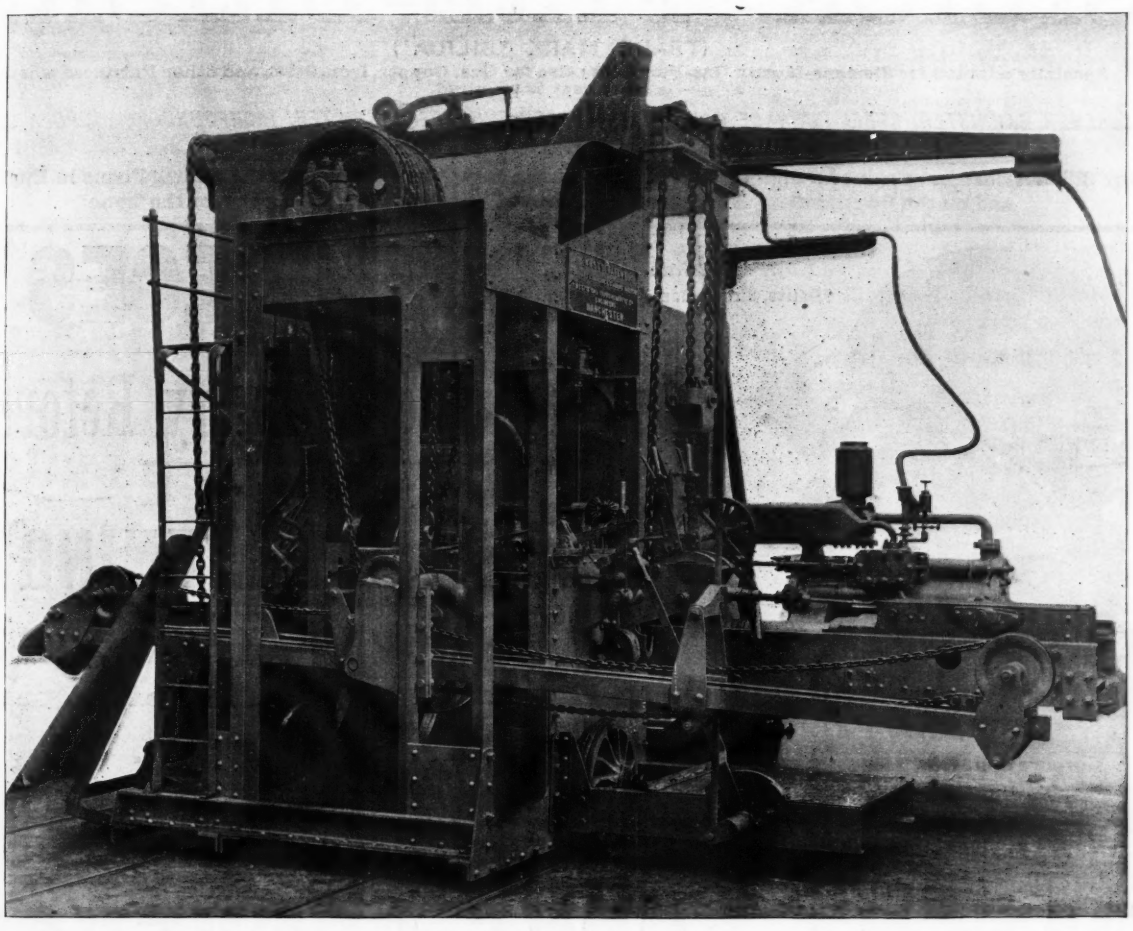
COMPRESSED AIR DRIVEN

CHARGING AND DRAWING MACHINES;

COMBINED CHARGING AND DRAWING MACHINES; also

MANUAL CHARGING AND DRAWING MACHINES.



West's compressed Air Driven Charging and Drawing Machine, requiring only One Machine driver and one attendant to charge and draw the Retorts, attend to the Mouthpieces, and fill the Furnaces.

All classes of Coal can be efficiently dealt with by the West's Charging Machines, and the Retorts are charged evenly throughout with the full weight of Coal.

Retort Houses fitted with West's Regenerator Furnaces, Stoking Machinery, and Coke Conveyors reduce the cost of Carbonizing Coal to a minimum.

WEST'S GAS IMPROVEMENT CO., LTD.,

Albion Iron-Works, MILES PLATTING, MANCHESTER,

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Manufacturers for America: RITER-CONLEY MANUFACTURING COMPANY, PITTSBURGH.

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MANUFACTURERS OF

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Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

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Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

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Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

Over 400 recently Supplied to the Corporation Gas Department, Saltley, Birmingham.

Telegraphic Address: "Motive, Birmingham."

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SPECIAL FASTENINGS.

WILLIAM GRICE & SONS, Ltd.,

Engineers & Gas-Engine Makers,

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London Office: 25, Victoria St., Westminster. Mr. A. B. Coote, Representative.

THE "DE BROUWER"

PATENT COKE-CONVEYOR

THESE CONVEYORS ARE NOW WORKING IN ENGLAND

AT THE FOLLOWING WORKS:—

CRYSTAL PALACE GAS COMPANY, BIRMINGHAM CORPORATION (SALTLEY STATION), GASLIGHT AND COKE COMPANY (SHOREDITCH STATION), NEWCASTLE AND GATESHEAD GAS COMPANY (REDHEUGH WORKS), DERBY GASLIGHT and COKE COMPANY (LITCHURCH STATION), WAKEFIELD GAS COMPANY, GASLIGHT and COKE COMPANY (NINE ELMS), and BURY CORPORATION (LANCASHIRE).

Orders have been received and in Hand for the

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Guaranteed by Sole Makers:

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CARBONIZING SPECIALISTS.

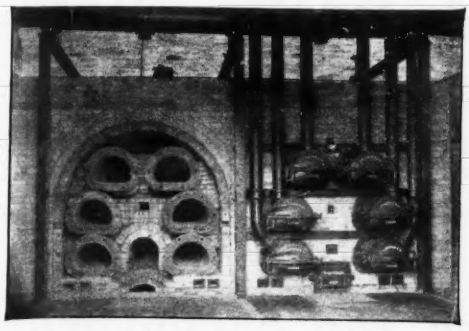

PHOTO. OF REGENERATOR SETTINGS DURING CONSTRUCTION.

REGENERATOR & GENERATOR SETTINGS

DEEP, SEMI-DEEP, AND SHALLOW.

Maximum Make per Ton and Mouthpiece.

Minimum Fuel Consumption.

NUMEROUS REPEAT ORDERS

Have been received for each of the above types of settings.

RESULTS GUARANTEED. RETORTS RESET.

SOLE MAKERS OF **CRIPPS' PATENT CHIMNEY.**

Designs and Estimates on application. 28, EAST PARADE, **LEEDS.**

THE DELLWIK-FLEISCHER WATER-GAS PROCESS

For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

(PATENTS IN ALL COUNTRIES)

THIS PROCESS HAS BEEN ADOPTED AT THE FOLLOWING GAS-WORKS:—

IN ENGLAND: WEST BROMWICH, ILFORD, TIPTON, CLEETHORPES, BILSTON.

ON THE CONTINENT: KÖNIGSBERG, ERFURT, ISERLOHN, REMSCHEID, PFORTZHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG, MÜLHEIM A/RUHR, LUDWIGSHAFEN, a/R., GÜSTROW, BERNE, LYONS, GIJON, ROME, ARNHEIM, BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG.*

[* Blue Water Gas with Incandescent Burners.]

ALSO FORTY INSTALLATIONS FOR MANUFACTURING PURPOSES.

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REDUCTION IN PRICE OF

"JENA" GLASS

INCANDESCENT GAS-LIGHT SPECIALITIES.

Owing to the enormous sales of this well-known Glass, we are able to make important Price Reductions, which come into force as from 1st January, 1903.

NEW JENA LIST, No. 161—consisting of Chimneys, Globes, and Lateral Air Supply Glasses—forwarded on application.

SPECIAL TERMS TO WHOLESALE HOUSES.

CONSIGNEES—

FALK, STADELMANN, & CO., LD.

"VERITAS" LAMP WORKS,

83, 85, & 87, FARRINGDON ROAD, LONDON, E.C.

SAML. CUTLER & SONS, MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

Gasworks Plant of every kind.

STEEL FRAMED BUILDINGS.

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CARBURETTED WATER GAS PLANT.

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CUTLER'S PATENT OIL SPRAYERS.
CUTLER'S PATENT TAR SEPARATOR.
CUTLER'S PATENT DUST INTERCEPTOR.

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OIL-TANKS. CHEMICAL PLANT.

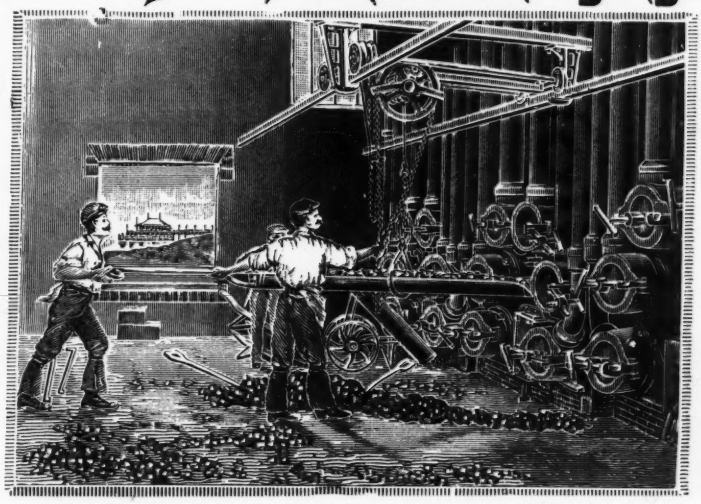
Makers of all kinds of Constructional Ironwork.

BIGGS, WALL, & CO.,

The Patent "Rapid" Manual Charging Apparatus

Installations Completed—

Aldershot Gas Co.
Ilfracombe Gas Co.
Goole Gas Committee
Worthing Gas Co.
Dunedin Gas Co.
Newport (Mon.) Gas Co.
Shrewsbury Gas Co.
Wrexham Gas Co.
Normanton Gas Co.
Truro Gas Co.
Harlow Gas Co.
Sligo Gas Co.
&c., &c., &c.



This view shows the "Rapid" Charger at work in the Ventnor Gas-Works, I. of W.

Installations in course of Construction—

Shanghai Gas Co.
Otley Gas Co.
Epsom Gas Co.
Southbank Gas Co.
Caterham Gas Co.
Brentwood Gas Co.
Napier Gas Co.
River Plate Gas Co.
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Telegrams: "RAGOUT, LONDON." Postal Address: 13, CROSS STREET, FINSBURY, LONDON, E.C.

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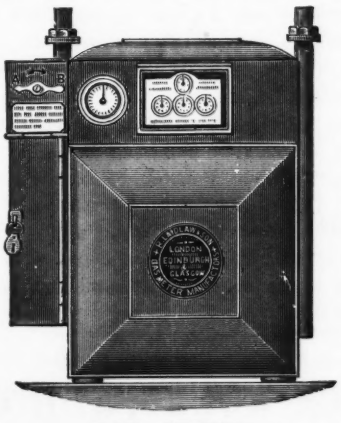
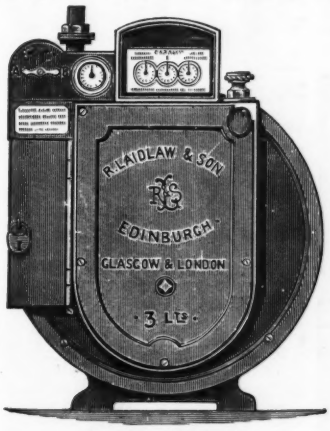
SIEMENS WATER-METERS,

PREPAYMENT GAS-METERS.



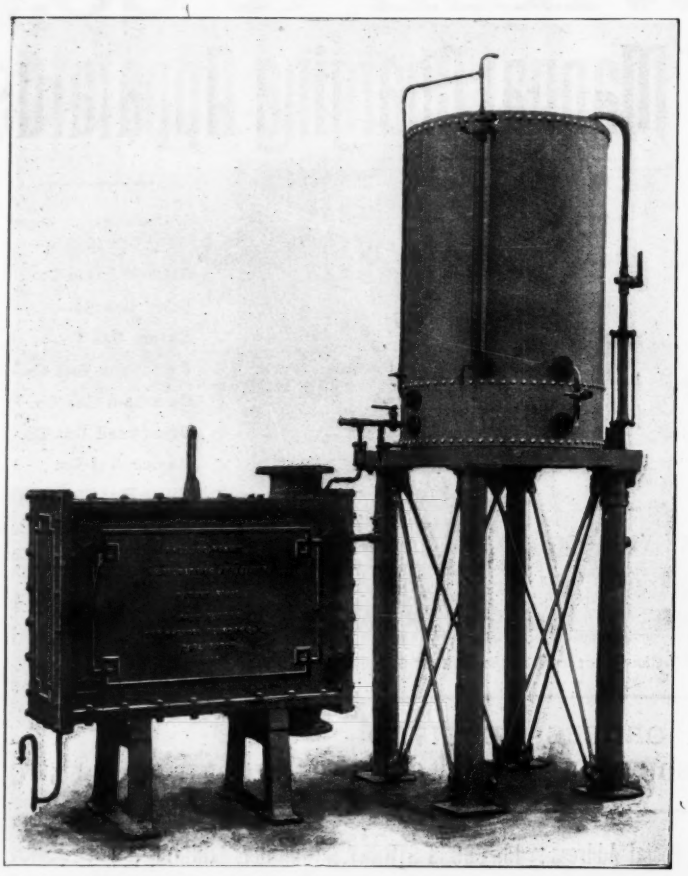
—DRY METER.—



—WET METER.—

EDINBURGH: SIMON SQUARE WORKS. | **GLASGOW:** ALLIANCE FOUNDRY | **LONDON:** 6, LITTLE BUSH LANE.

"WHESSOE-MUNICH" BENZOL CARBURETTING APPARATUS.



Working at Tynemouth, Middlesbrough, Darlington, Bilston, West Bromwich, South Shields, and many Continental Gas-Works.

Cheapest and most Effective Plant.

Permanent Enrichment obtained Instantaneously.

Sole Makers—

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Works: **DARLINGTON.**

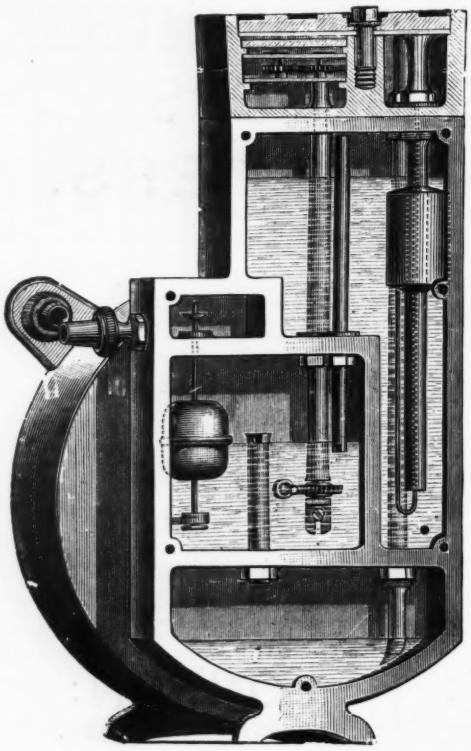
London Office: **106, CANNON STREET, E.C.**

ALDER AND MACKAY.

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



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GREEN'S PATENT UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost No box is required; and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s.; and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 3½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

Prices and all Information on Application.

NEW GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

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Have all your PURIFIERS

Made in the new Foundry of

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Whose Works at Stockton-on-Tees are situated

in the Centre of the

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AND LEATHER MANUFACTURERS,
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GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas and Other Purposes.
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UPPER GROUND STREET, LONDON, S.E.,
SUPPLY FROM STOCK
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SOCKET-PIPES FOR GAS OR WATER PURPOSES.
FLANGE PIPES FOR STEAM.
Sole Manufacturers of LYON'S "PATENT" GAS-MAIN SYPHONS.
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Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.
RETORTS CAREFULLY PACKED FOR EXPORT.
Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

MACBETH-EVANS GLASS CO.,
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Best Materials and Workmanship Guaranteed.

Miners' Woollen Jackets No. 1, 12/- each; No. 2, 9/6.
Gas-Bags for Mains. Gas-Engine Bags.
71, GOSWELL ROAD, E.C.

THE "LUX-CALOR" TRADE MARK.
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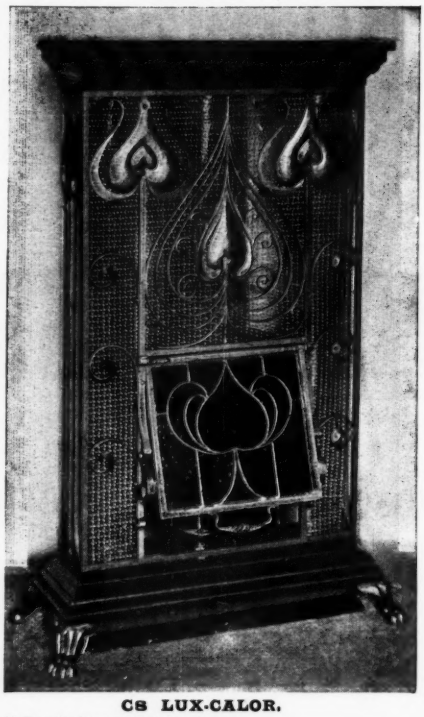
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MAKERS OF THE
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THE ORIGINAL MAKERS OF
SPIRAL GUIDED GASHOLDERS
MAKERS OF ALL KINDS OF
STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS ROOFS RETORT FITTINGS PURIFIERS RETORT LIDS ANTIFREEZERS for Gasholders
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OF ALL SIZES
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OF EVERY DESCRIPTION & SIZE
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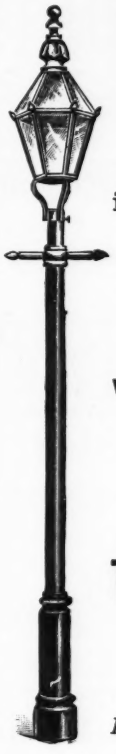

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made throughout of
WELDLESS STEEL TUBING
including base, ring, and ladder rest.

Light, Strong, Unbreakable, and Cheap.

GAS, WATER & STEAM TUBES AND FITTINGS.

WELDLESS STEEL SPIGOT & FAUCET PIPES
for Gas and Water Mains.

Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.

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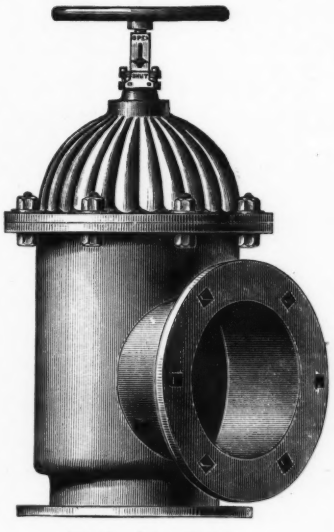
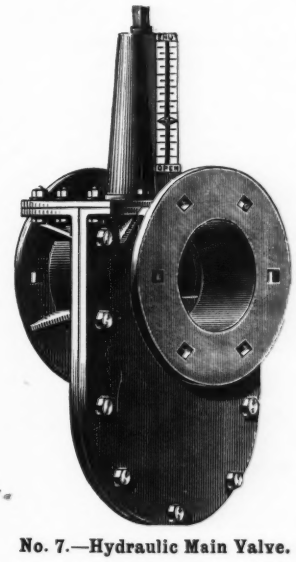
Gas Valves of every description.



No. 6.—Disc Valve.



No. 7.—Hydraulic Main Valve.

All Valves Tested before delivery. Over 600 Valves kept in Stock for immediate delivery.

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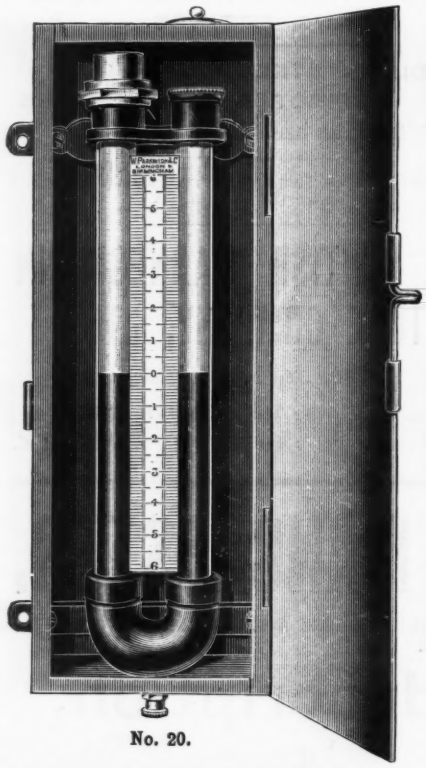
The following engravings show a variety of Gauges adapted for different positions on a Gas-Works. The mountings are either of white metal, brass, or gun metal. We pay the greatest attention both to the finish of the mountings and to the selection of the glass tubes used, while every gauge is thoroughly tested for soundness before leaving our works.



No. 20.

Fig. 2.

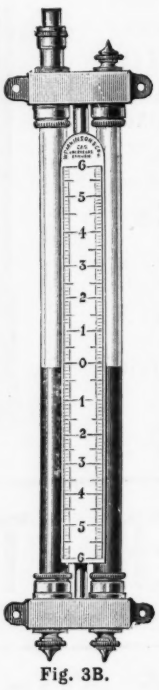


Fig. 3B.

Fig. 1.

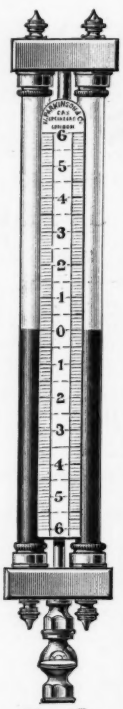


Fig. 5B.

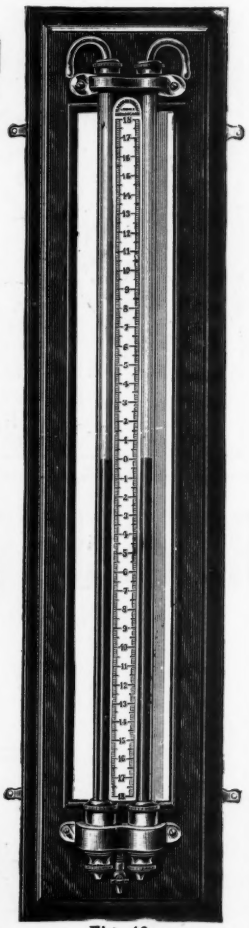
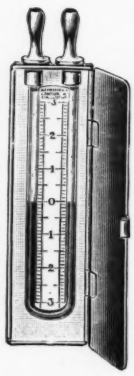


Fig. 10



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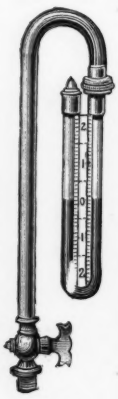
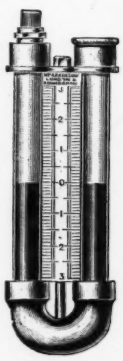


Fig. 6.



No. 28.

Fig. 9.

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[See also Advt. p. 12.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Jan. 6, 1903.